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WT&T

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Member; American Business Press, Business Publications Audit, National Golf Foundation, American Sod Producers Association, Associated Landscape Contractors of America, National Landscape Association, Horticultural Research Institute.

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GREEN INDUSTRY NEWS

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VIEWPOINT

Bruce F. Shank, Editor

Action is needed to stop loss of extension personnel

Cuts in agricultural extension programs serving the Green Industry prove that the message of the significance of our industries is not getting to Congress. More than 1,000 extension personnel lose their jobs to budget cuts each year and a gloomy fiscal 1980 budget will not improve the situation.

How long are we going to wait until we act, make our respresentatives be responsive to our needs and to recognize the significance of our markets?

What's the use? Senators and Congressmen never see their mail, they just have an aide send a form letter telling you how the regulations make any improvements impossible.

Fortunately, in this case, the solution has become the responsibility of an Advisory Board, The National Agricultural Research and Extension Users Advisory Board. The first meeting of this Board was announced to the trade press two weeks prior to the meeting in Washington April 30, not much time to prepare or plan to attend in my opinion.

There is still a chance for input if we act immediately. The NAREUAB will begin preparation of a report to the President and Secretary of Agriculture at a meeting scheduled for July 10. The group will submit this report in October and must have it completed sometime in September.

Currently, the Board is made up of 21 appointees, none of which represent the turf or ornamental horticulture industries. There are however, appointees representing environmental interest groups, agricultural production and nutrition. These individuals have strong feelings about their industries and will devote their full attention to these. Noone is there to represent the Green Industries.

Agricultural lobbyists lack concern for the Green Industries. The USDA is made up of hard core agricultural personnel who got their education at Land Grant Colleges, few, if any in ornamental horticulture or turf management. They seem to overlook the non-food markets when policy decisions are being considered.

The Green Industries can't rely on the farmer for protecting their extension service helpers. Our associations must quickly make direct contact with the Advisory Board to represent our interests during the priority setting sessions.

The person to contact is James Meyers, Executive Secretary, National Agricultural Research and Extension Users Advisory Board, Room 349-A, U.S. Department of Agriculture, Washington, D.C., 20250, 202/447-3684. The USDA Information Office has assigned Howard Hass to cover the Board full time. He can be contacted at 202/447-2863.

Input from landscape contractors, nurserymen, arborists, golf course superintendents, irrigation contractors, and reclamation supervisors is essential to avoid further cutbacks in ornamental and turf programs through extension.

Currently, the President's budget is $40 million beneath the amount conservatively proposed by the National Association of County Agricultural Agents. Its figures were based upon a 7 percent inflation rate, far below the actual 14 percent rate.

The President has proposed a reduction in both extension and research budgets in 1980 from 1979. Maintaining current levels would have required cutbacks because of inflation. A reduction will mean severe cutbacks in extension and research services. The President has proposed a serious near elimination of the programs for agricultural teaching and education. This translates into 600 lost teaching jobs and a severe reduction in training of future educators for agricultural sciences.

Urban Forestry programs, an effort to replace lost vegetation in urban areas, is listed as the lowest priority for extension. Before it comes maintenance of current programs, restoration of programs cut by the President, and nutrition research.

We all realize that to balance the budget some things have to be cut. But the President is cutting his own budget to pieces if he discontinues programs which result in more tax revenue through increased output.

Extension and research are some of the few programs in government that provide a return on investment. Measuring the return is difficult and therefore disregarded by policy makers. Furthermore, they never will be inclined to measure return until they are encouraged by voters to do so.

A single vote may seem insignificant, but thousands make representatives take notice. The Green Industries must use the power of the vote to make their message heard, now, and with permanent reinforcement.

I think most of us, including this magazine, have neglected what goes on in Washington. Apathy some call it, or avoiding the complex and unpleasant things in life. This negligence could cost us in jobs and growth in the future if we don't act now.

Weeds Trees & Turf will strive to uncover and pass on more government news in the future. We will arrange and publish interviews with key officials affecting the Green Industries. We will publish news about association efforts in Washington.

Hopefully, with this material in your hands, you and 45,000 other readers can have an influence on government by knowledgeable reaction to policies that affect your business. **WTT**

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GREEN INDUSTRY NEWS

ARBORIST

Urban forestry suspected as intrusion

The private sector should be wary of the possible consequences of the Cooperative Forestry Assistance Act, according to a spokesman for the National Arborist Association.

Robert Felix, NAA executive secretary, said the act could lead to the formation of a federal agency to regulate the "urban forest" industry.

The Forestry Assistance Act distributes about $70,000 to each state to provide technical assistance to municipalities for urban forestry. The funds are distributed to the states by the U.S. Forest Service through state foresters.

The technical assistance provided includes:

- Planting and maintenance recommendations for tree ordinances.
- Insect and disease control recommendations.
- Development and utilization of urban tree inventories.
- Development of and recommendations for tree ordinances.
- Recommendations for the establishment of municipal forestry departments.
- Recommendations for the protection of the environment during new home or building construction.
- Multiple use management recommendations and plans for municipally owned forest lands.
- Workshops, programs, and slide shows on urban forestry.

"All of these suggested programs are valid, and where such assistance is appropriate is of great value to the public," he said. "However, suppose this assistance . . . begins to infringe on the private sector? Suppose new regulatory agencies, federal or state, were created to administer all of this?"

Felix added that government concern has historically resulted in the formation of regulatory agencies such as the Occupational Safety and Health Administration and the Environmental Protection Agency. "Regulatory agencies have become the fourth branch of government and cost American taxpayers over $100 billion last year to operate," he said. "Indeed we should be cautious."

According to Felix, much of the technical assistance provided in the act is unwarranted. "Many arborists, commercial and municipal, are perfectly capable of providing all of the technical assistance that is necessary with respect to the care of existing trees and many with respect to the planting of new trees . . .," he said.

"We do not need another layer of government bureaucracy imposed on us either as practitioners or as taxpayers," he added.

Thomas V. Bruns has been named president of the Jacobsen Division of Textron, Inc.

CHEMICALS

Velsicol appoints former EPA official

John M. Rademacher, a former senior official of the United States Environmental Protection Agency, has been named vice-president of environmental, health, and regulatory affairs for the Velsicol Chemical Corp.

He and his department will have direct operating control over environmental and health related matters, along with the company's relationship with the appropriate regulatory agencies.

A long-time federal environmental executive, Rademacher most recently served as a special assistant to EPA's assistant administrator for enforcement, in Washington, D.C. While a special assistant he provided technical evaluations of all EPA enforcement action, including air, water, and hazardous and toxic waste programs.

Rademacher has also served as a regional adminstrator for EPA and its predecessor agency, the Federal Water Quality Administration. A registered professional sanitary engineer, Rademacher obtained his bachelor's degree from Purdue University and his graduate degree from Northwestern University.

He is currently serving as president of the Federal Water Quality Association, an affiliate of the Water Pollution Control Federation.

IRRIGATION

Toro to expand irrigation division

The Toro Co. has announced that it will invest more than $3 million over three years in a new expansion program for its Irrigation Division in Riverside, Calif.

The expansion plans call for the addition of 118,000 square feet of factory, office, and warehouse space at an estimated cost of about $3.4 million. Toro's current facility in Riverside totals about 159,000 square feet.

Toro Chairman David T. McLaughlin said Irrigation Division sales have increased more than 100 percent during the past two years. In the last fiscal year, which ended July 31, irrigation sales accounted for $24.2 million of the company's $227 million in total sales.

SEED

Oregon seed groups repair Capital turf

The Oregon Grass Seed Industry rallied to the aid of the 24 acres of lawn in the Nation's Capital which were damaged during the farmers' occupation last winter.

A combined effort of the Oregon Seed Council, Seed Trade Association, and Seed Grower's League produced the 7200 pounds of special grass seed mixture which was required for the project.

The seed, all Oregon grown, is a special mix which was requested by the National Parks Service. It is Kentucky Bluegrass, Penn Lawn Red Fescue, and Fawn Tall Fescue. It is a mixture designed to be most effective for the climate and the specific needs of the area to be planted.

The idea was born during an Oregon Seed Council meeting. It was noted that nurserymen were going to replant the shrubbery and Maryland farmers were going to prepare a seedbed. C. M. "Brownie" Brownell, Treasurer of the Council, coordinated an effort that brought the other seed organizations into the picture.

Landscape Contractor News

Operating cost survey developed

An operating cost ratio survey of the landscape contracting industry is currently being conducted by the Associated Landscape Contractors of America (ALCA). The survey is completely confidential and will focus on operating cost data, along with pertinent data on standard financial reports.

John Shaw, ALCA president, said the survey is being sent to about 3800 landscape contractors across the United States. "The purpose of the survey is to develop statistical information about the industry," he said.

The survey is constructed so the complete confidentiality of the reported information is guaranteed through a response verification system. Further responses are directed straight to the data processing firm which will compile the data.

The report information will be broken down into a variety of areas including company size and geographical area covered, along with an analysis of department and division data. The final report will also include a narrative analysis of the data.

The survey report, to be published this fall, will be sent directly to all landscape contractors who participated in the survey and will be available for sale to all others. Additional survey information is available from ALCA, 1750 Old Meadow Road, McLean, VA 22102.

Judges named in CLCA competition

The California Landscape Contractors Association recently named the judges for its 20th Annual Landscape Beautification Awards Program, according to Bill Vandergeest, 1979 program chairman and owner of Vandergeest Landscape Care, Santa Ana, Calif.

Judges include Keith French, landscape coordinator for S & S Construction Co.; Jerry Driscoll, manager of California Trees, Inc.; and Fred Ridge, president of PCM, Inc.

Judging for the annual awards will be held June 2-3 and the awards will be presented at the organization's annual banquet, June 27, at the Revere House Restaurant, Tustin, Calif. Winners will not be announced until the awards banquet.

Commercial and residential landscaping projects which have been completed since May 1, 1978 qualify for the competition. For further information contact the Landscape Beautification Awards, c/o Bill Vandergeest, 3342 Castor St., Santa Ana, CA 92704.

Residential design program planned

The ALCA Residential Design Short Course will be held in Phoenix, Ariz. and Seattle, Wash. in late June. The three-day program features lectures, problem-solving sessions, and board exercises on all aspects of residential landscape design.

The program will again be conducted by Jot Carpenter, chairman of the Ohio State University Landscape Architecture Department. Additional OSU resource personnel will also participate in the sessions.

The Phoenix program, co-sponsored by the Arizona Landscape Contractors Association, will be held June 21-23 at the Townhouse Hotel. The Seattle program, co-sponsored by the Washington Nurserymen's Association, will be held June 25-27 at the Lutheran Institute of Seattle.

The course is intended for landscape contractors involved in landscape installation who don't have any formal training or previous experience in design. All phases of landscape design will be discussed including scaling, lettering and graphics, functional diagrams, form and composition, plant functions, design principles, plan development, and final designs.

The program is open to all interested persons. For further information or registration materials contact the Associated Landscape Contractors of America, 1750 Old Meadow Road, McLean, VA 22102.

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LANDSCAPE

Three more groups affiliate with ALCA

The Wisconsin Landscape Contractors Association, the Landscape Contractors of Utah, and the Arizona Landscape Contractors Association have become Sponsoring Members (state affiliates) of the Associated Landscape Contractors of America. They join seven other state/regional associations, bringing the total to ten.

The Sponsoring Member category is the term for organizational membership in ALCA, and is the mechanism through which state and regional groups may affiliate with ALCA. Under the Sponsoring Member arrangement, member firms of WLCA, LCU, and AzLCA gain direct access to all ALCA publications and meetings.

Other state/regional groups holding Sponsoring Membership in ALCA are: California, Illinois, Colorado, Washington, D.C., New York, Texas, and Florida.

PESTICIDE

Orthene registered for California scale control

Orthene Tree and Ornamental Spray has received a California Special Local Need (SLN) registration for control of scale on ice plant ground cover along highway rightofways. The registration allows the use of Orthene as needed for scale control in the crawler stage at the rate of two-thirds pound of formulation per 100 gallons of water, applied with conventional hydraulic sprayer.

ARBORISTS

ASCA names Schultz as 1979 President

The American Society of Consulting Arborists recently elected new officers to serve in 1979. Those elected included Jack A. Schultz, New York, president; John Z. Duling, Indiana, president-elect; William J. Griffin, California, vice-president; and Edwin E. Irish, Michigan, secretary-treasurer. Spencer H. Davis, Jr., New Jersey, was named executive director.

GOVERNMENT UPDATE

Dow withdraws from suspension hearings

The Dow Chemical Co. recently announced its withdrawal from EPA's 'suspension' hearings concerning the herbicides 2,4,5-T and Silvex. At the same time, Dow filed several motions with EPA's chief administrative law judge seeking prompt initiation of a broad fact-finding hearing on EPA's proposed cancellation of the registration of the herbicides.

Dow attorney Michael J. Traynor said the company withdrew from the 'suspension' hearings because the "fundamental issues" of the long-term safety and benefits of the products were not being considered by the panel.

"This action is not an abandonment of the products or their defense," he said, "but simply a means to expedite the final resolution of their futures by beginning the cancellation hearings immediately."

"Specifically," Traynor said, "our requests are that EPA promptly assign an Administrative Law Judge (ALJ) and schedule a pre-hearing conference so we can move forward with a full examination and ultimate government decision on the risks and benefits of these products." A pre-hearing conference was scheduled for June 5 in Washington, D.C.

In related news, agency officials said the major issue now confronting EPA is how they will pay for and carry out the Silvex indemnification agreement it signed with the Chevron Chemical Co. Agency enforcement officials said if the agency doesn't obtain additional funding through supplemental budget requests, the issue will likely end up in the courts. One official said, "I don't know why the government should agree to pay for products that the companies probably knew were hazardous to begin with."

EPA rules Evergreen an applicator

Evergreen Pest Control is not a "distributor" based on the definition of the word in FIFRA Section 14(a)(1), according to Paul De Falco, EPA regional IX administrator. The decision reaffirms an earlier ruling by EPA Judicial Officer Anthony O. Garvin, but contradicts a decision by Administrative Law Judge Gerald Harwood.

De Falco's ruling that the company is an "applicator" of pesticides versus a "distributor" means that Evergreen Pest Control will be subject to less stringent FIFRA penalty provisions for its alleged misuse of methyl bromide. Further, the ruling could have an affect on future court rulings concerning the distributor vs. applicator debate.

In making his final decision, De Falco said, " . . . although the evidence indicates that Evergreen regularly kept stock of pesticides on its premises for use in its business, there is no evidence in the record to indicate that Evergreen ever resold or otherwise distributed these pesticides to other companies or individuals."

Drinking water regulations proposed

EPA has proposed regulations designed to prevent pollution of the underground sources of drinking water that now serve one-half of the United States population.

EPA will provide up to $6 million this year to help states set up and enforce programs to insure that the underground injection of liquid wastes and other fluids does not endanger subsurface drinking water.

The agency has estimated that there are more than 500,000 injection wells that now have the potential to contaminate groundwater and that number increases by about 5,000 each year.

Basically, EPA's regulations call upon the states to set up programs to review all underground injection operations and take any remedial action necessary to protect groundwater. Injection wells would be inspected to make sure they are properly constructed and maintained. Safe injection operations that are not potentially dangerous could continue, but they would have to comply with permits and rules issued by the states or EPA.

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SYMPTOMS AND CONDITIONS OF ENVIRONMENTAL TREE DISEASE

By Eugene P. Van Arsdel

Environmental diseases are those caused by the adverse effects of the environment on the tree.

The maladies fit my definition of diseases better when they are more or less continuous, but many authors include lightning as a non-infectious disease. The adverse environmental conditions can be physical or chemical and can affect the plant directly or through the soil, water, or air. Direct physical disturbances can be mechanical injuries to the above ground parts of the tree, but more commonly they are to the roots because people are not very much aware of the part of the tree that is underground. Physical changes in the level or drainage of the soil are often harmful. Harmful chemicals can be in the soil, the water, the air, or may be applied by people. Physical changes in the atmosphere such as adverse weather (e.g. early or late frost) or sudden changes in the microenvironment (e.g. changes in a nearby structure), or the introduction of chemicals (air pollution). Environmental maladies involve several species of plants more often than infectious or biological diseases do, and they often stop at the property ownership lines.

Eugene Van Arsdel is Associate Professor of Forest Pathology at Texas A & M University's College of Agriculture. Dr. Van Arsdel is a member of the Weeds Trees & Turf Advisory Board.

Sycamore seedling showing salt injured lower leaves caused by watering with high chloride content water. Newer leaves grew in rainy period and have no chloride symptoms.

Trees Affected

All trees can be affected by environmental maladies at some level of almost anything; e.g. live oaks are resistant to salt, but enough salt is frequently accumulated to poison them. Some species of trees are more susceptible to one environmental factor than another: American elms withstand excess water much better than many other trees (since most people water too often, this contributed to their success as a shade tree before the Dutch elm disease epidemic); however, in sub-humid regions (central Texas) where slightly saline irrigation water is common the elms usually die from the salt before oaks do. Evergreen trees are often more susceptible to air pollutants than deciduous trees, generally because the evergreen leaves stay on longer to be affected by the pollutants.

Occurrence

Environmental diseases can occur anywhere, but they are particularly prevalent in the urban environment where man has had the greatest influence. Frost and sunscald are widespread, other maladies are often confined to particular areas; e.g. there is almost always a great deal of sulfur dioxide pollution injury around a copper, lead or zinc smelter. Locations are important in the diagnosis of environmental diseases. The coastal areas have special problems with storms blowing sea water inland to injure trees with salt. The damage can cover large areas, but only within a few miles of the coast.

Damage

The damage ranges from hardly noticeable to widespread death of the trees. Salt in the irrigation water can cause a slight dwarfing of leaves that is hardly noticeable to all but the most careful observers, but certain smelters are famous for being surrounded by miles of dead trees and denuded land (Linzon 1968).

Symptoms

The symptoms showing that environmental injury is occurring are varied, but many can be detected from leaf symptoms. These have been presented in another paper (Van Arsdel 1978). Some specific symptoms of the particular groups of maladies are presented later. Some generalized symptoms are those of root smothering: the leaves

turn yellowish with no definite lines between color changes. Nearly all of the leaves are involved and the injury is not restricted to either new leaves or old ones. These symptoms are characteristic of natural gas leaks, earth fill over the roots, flooding or interrupted drainage, or daily watering. Gas leaks probably involve several species of plants, and usually involve the grass too.

Control

The key to controlling environmental diseases is to determine the cause, then the cure often becomes evident. If a natural gas leak is the problem, much of the injury is permanent, but additional injury can be prevented by fixing the leak and aerating the soil (by pumping compressed air through, leaving the excavation hole open, etc.). To control air pollution, usually the source must be controlled. At times raising the stack height helps, but often that merely transfers the problem to another location. Other more specific controls will be discussed in the detailed sections of the paper handling the particular environmental disease.

Causes

The causes of environmental disease are many, and more are discovered each year, particularly as the human population increases, and the works of man encroach upon the natural environment more and more. A list of some of the more common ones are listed below.

Soil Disturbance — Construction Injury

Some builders and developers do many acts that often injure trees in the vicinity of their work. With their heavy equipment, such as bulldozers, the trees do not have much of a chance of surviving unless special care is taken to preserve the trees.

A partial list of these damages follow — roughly in the order of the amount of damage they do: (1) The worst is where they mean to kill the tree, and they push it over with a bulldozer and run heavy equipment over it. (2) Not quite as bad, but just as fatal is when they push the whole tree aside with the bulldozer along with a small island of attached dirt and leave the tree standing in a new location with only a small part of its roots to absorb water from the ground to supply the leaves with their required water. (3) They fill soil over the ground at the base of the tree which contains its roots. (4) They interrupt the drainage with a house, a wall, a sidewalk, or a mound of earth that makes the water back-up and suffocates the roots by flooding. (5) They cut the roots off when they excavate for foundation walls, service lines, sidewalks, streets, etc. (6) They crush the roots and break them up by running heavy equipment over the soil that contains them. (7) They wound and skin the bark on the stem by running tractors, trucks, etc. over them. (8) They drip oil from the crankcases and gear boxes onto the soil. This is both poisonous to the trees and prevents rainwater penetration. (9) They permit the ready-mix concrete trucks to dump concrete onto the soil, then they spread a thin layer of fill over it so you can not see where it is. (10) They run

Causes of environmental diseases:

1. Meteorological effects
   - A. Frost (low temperature)
   - B. Sunscald (high temperature)
   - C. Light
   - D. Drought
   - E. Lightning
   - F. Winter kill (warm wind with frozen ground)
2. Air pollution
   - A. Reducers
     - (1) Sulfur dioxide
   - B. Oxidizers
     - (1) Ozone
     - (2) Peroxy-acetyl-nitrate (PAN)
     - (3) Flourides
     - (4) Chlorides
   - C. Combinations (synergists)
     - (1) SO_2 and Ozone
   - D. Growth modifiers
     - (1) Ethylene
     - (2) 2,4-D, 2,4,5-T and other herbicides
   - E. Salts
     - (1) Blown seawater in natural salt storms
3. Water problems
   - A. Changes in amount or level
     - (1) Dams or other flooding (root smothering)
     - (2) Too frequent watering (sprinkler irrigation flooding — most common with automatic sprinkler systems) (root smothering)
     - (3) Complete change in watering cycle (stop watering for vacation trip)
   - B. Water pollution
     - (1) Salts in the irrigation water (common with many city water systems — often worst on house plants)
4. Soil modification
   - A. Mechanical (Bulldozer blight)
     - (1) Earth filling over the soil surface above the roots (root smothering)
     - (2) Cuts, ditches, sidewalks, and street grades (root cutting)
     - (3) Building foundation cuts (root cutting)
     - (4) Covering surface with asphalt, concrete or plastic (root smothering)
     - (5) Lowering water table by ditching
   - B. Chemical injuries (soil pollution)
     - (1) Salt injury
       - a. Irrigation water
       - b. Road salt
       - c. Oil wells (brine pools, etc.)
       - d. Mine tailings
       - e. Dog urine (male dogs on the corner shrubs)
     - (2) Excess fertilizer
     - (3) Illuminating or heating gas
       - a. coal gas (Ethylene)
       - b. natural gas (lack of oxygen = root smothering)
     - (4) Herbicide injury (Atrazine in grass fertilizer, or deliberate application — may be to driveway or fence)
5. Mechanical injuries to plant
   - A. Logging injuries
   - B. Lawnmower skinning
   - C. Rubbed spots, bumper skins, etc.
   - D. Broken branches
   - (1) Snow and ice breakage
     - (2) Bad pruning
     - (3) Truck breakage to branches.

the big trucks through the trees so they break up the branches, leaving exposed jagged branch stubs to serve as perfect entry courts for disease and decay fungi. (11) Lastly they cut the trees up for firewood and leave it there in a pile next to the base of a living tree. The fungus-bearing wood borers come out of the wood and enter the adjacent tree and transfer the local wilt fungus to the tree.

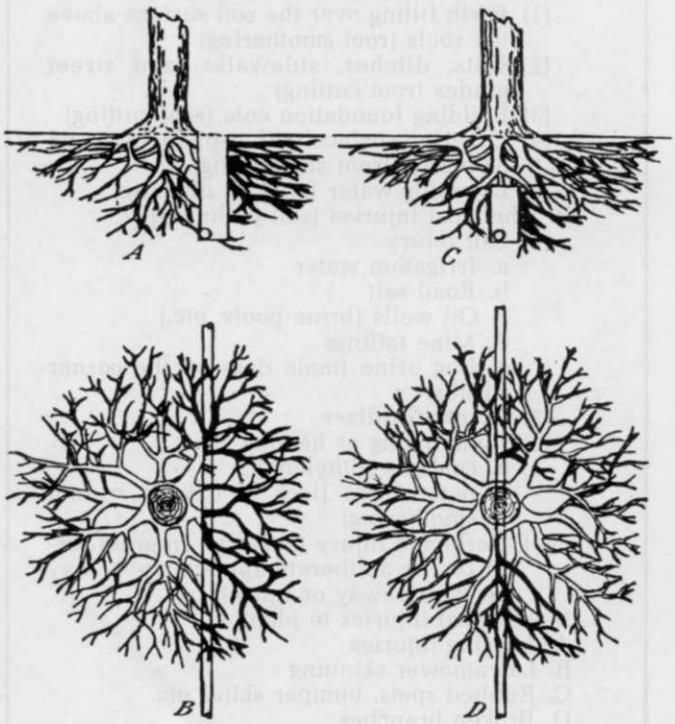
Symptoms

The symptoms of construction injuries often do not show until after the damage has been done, and often not until it is too late to save the trees. The symptoms of root suffocation (earth fill over the roots and dams raising the water level) are that the leaves turn yellow, with a general discoloration, the transitions from discolored to green parts are gradual.

Elms will die from saline irrigation before oaks will. Evergreens are often more susceptible to pollutants.

Control

The control of some of the construction injuries is possible after the damage has been done. It is expensive and difficult, and involves the excavation around the trees, the sterilization of the bark (some use alcohol, I have used 10% bleach), and the recreation of proper drainage by the installation of the drain tiles and French drains as shown in the following section on prevention. The drainage must be returned to the original soil level; this is usually easy to detect by the organic matter layer (or dark soil layer) at the original soil line. These construction injuries are much easier to prevent than to cure, so the major emphasis is placed on the prevention.



Root severing from trenching near tree. Fewer roots are severed by trenching directly to the trunk of the tree (D) and tunneling under the base (C) then trenching alongside (A,B). Severed roots are shown as black.

Reducing damage to trees during construction

A. Maintenance of the original soil surface and drainage level is the most important part of preserving the living tree.

1. Maintain the original soil surface if possible. The duff is full of fine roots. Removing the duff layer removes the fine roots and removes important sources of nutrients and important structural features.

2. Maintain the original drainage level. The roots are in one or two narrow strata (one in the surface duff, the other just above the normal water table) any change in drainage either smothers the roots by inundation, or leaves them high and dry without moisture.

3. Where the grade must be lowered for a street, maintain the surface around the tree and build a retaining wall.

4. When filling, use drain tiles or French drains (covered ditches partially filled with coarse gravel) to maintain the original drainage level.

5. Avoid creating dams. House foundation footings are the most common dams. Trees die on the uphill side of the house, or in the courtyard.

B. Protect trees during construction.

1. Protect against skinning, barking, bumping, and the like.

2. Protect against soil compaction by tractors, trucks, etc.

3. Protect against root smothering from earth fill over the roots. Planks or slabs fastened to the tree do not protect the roots.

C. Keep root cutting to minimum. Keep the trenches beyond the crown drip-line, or tunnel under the tree. The figure on this page illustrates how cutting beside a tree cuts more roots off than going directly under it.

D. When fill around the tree is necessary, maintain the bark free from soil contact by constructing a mortarless wall around a well.
Do not fill to reduce brush killing for sod establishment. Sod only where necessary construction fill demands. To preserve the soil level and the trees, mow the brush and insert grass cuttings without fill. Keep the brush mowed until grass crowds out the woody plants and weeds.

E. Maintain original drainage line at the old soil surface by drain tiles, French drains or both.

F. Trees must be watered at the original soil line where there is fill. Therefore the bell tile openings should be lower than the surface to allow rain-

water to flow in. Well water and public water supplies usually have enough salt to cause injury when the amount of rainwater is reduced for prolonged periods. Tile tops should be protected from debris.

G. A superior type of well for preserving the tree roots through earth fill is the open dry well.

H. After the construction and change in grade, prune the leafy crown to reduce the leaf area by the same amount that the root area has been reduced. Assume a fifty percent reduction as the usual minimum. Prune by cutting out twigs. Cut every other twig to reduce the crown 50 percent.

Excess Watering and Saline Irrigation

Excess water can damage trees in three ways: (1) Daily watering smothers the roots by keeping them wet and sealing the soil surface which prevents the oxygen in the air from getting to the roots. (2) Slightly saline irrigation water that is satisfactory for irrigating lawn grass and many annual crops causes a buildup of salt in the leaves of perennials until toxic levels (more than 3000 ppm chloride) are reached. The salt is left behind in the leaves similar to the residue left behind in distilation. (3) The third type of excess watering problem is a longer term result that becomes evident after a few years. Water with high sodium content leaves residues of sodium in the soil. The plants take up the chloride, but the sodium is left behind. The pH of the soil goes up to more than 8.3 as the sodium accumulates. The condition that develops is called "black alkali", the structure of the soil collapses and the trees die.

Most chemistry laboratories can test the leaves for chloride and the soils for pH and sodium content. The soil can be tested for chloride as well, but we have not found the chlorides accumulating in the soil. The irrigating water can be checked in laboratory tests as well, but there are probably published data on the salt contents of the water.

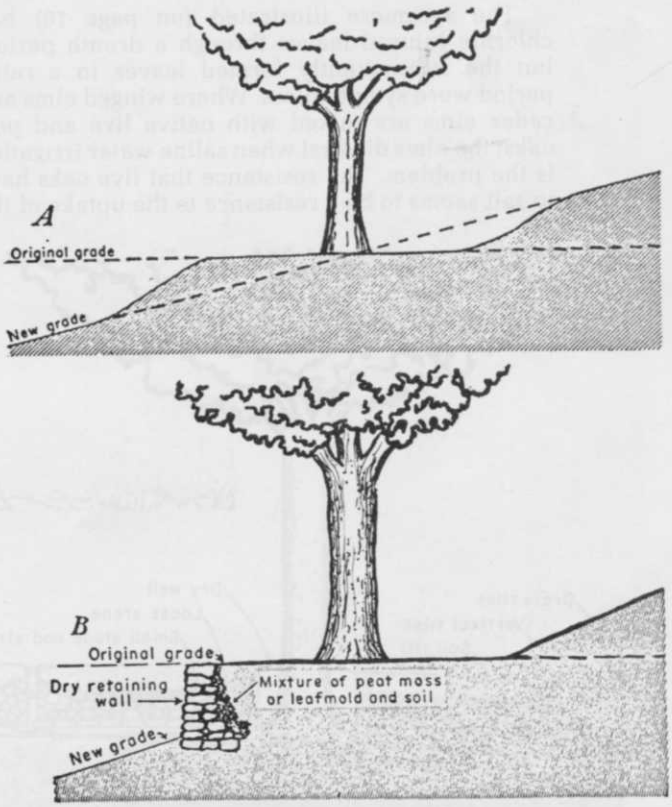
To determine what salts are present in the irrigating water, check the state reports of water quality. In Texas the Department of Health, Division of Water Hygiene has the salt contents of all public water supplies and publishes these analyses in a book (Texas Board of Health 1977). For information on salt in private water supplies, The Texas Department of Water Resources has books on water quality for most counties (Texas Department of Water Resources 1977). The salt contents of waters in most aquifers and many individual wells are listed.

The level of salt content in the irrigation water which is sufficient to start injuring the perennial vegetation is dependent upon the evaporation rate, the amount of rainfall, how long the plants have gone without rain, and the habits of the home owner who is doing the watering. All of the public water supplies with their dissolved ion counts presented in the following table have been associated with salt injury and high salt contents in the leaves. On the basis of this information, it would seem that outdoor watering in a subhumid region with water containing more than 45 ppm chloride is likely to produce toxicity problems in trees. House plants, greenhouse plants, and other plants in containers under roofs where rain cannot fall usually have salt problems unless they are watered with rain water or condensation water from air conditioner coils.

In the northern parts of the United States and in the mountains where snow is common, salt is often spread on the roads to melt the snow and ice; this is concentrated by snowplows and in drainage-ways. The salt injury is common in parking lots where the salted snow is piled up around the ornamental trees and shrubs. On curvy mountain roads and switchbacks the salted snow is pushed off the roads

Table 1. Concentrations of selected ions in public water supplies.

County and City	Reaction	Calcium Ca	Magnesium Mg	Sodium Na	Sulfate SO_4	Chloride Cl	Total Dissolved Solids	Total Hardness
	pH	ppm	ppm	ppm	ppm	ppm	ppm	
BRAZOS CO.								
Bryan	8.4	2	<1	188	<4	48	670	34
College Station	8.5	2	1	317	<4	99	1100	10
TAMU M. Camp.	8.4	4	1	205	7	56	730	12
TAMU Annex	8.5	3	1	239	<4	63	840	12
TAMU Univ. Ac.	8.3	10	<1	456	220	329	144	26
DE WITT Cuero	8.8	10	2	255	42	152	860	31
KERR Kerrville	7.8	72	36	27	27	47	590	340
LIVE OAK Geo. West	8.1	54	14	319	227	272	1260	195
Three Rivers	7.2	274	1	121	356	249	1290	690
TRAVIS Austin	9.5	18	14	28	33	52	201	103
WICHITA Wichita Falls	7.7	43	7	72	27	137	404	137



Preserving a maximum number of roots through a general grade lowering by terracing (A) and erecting a dry retaining wall (B).

on the outside of the curves and tree injury or death is often found in such places.

Symptoms

The symptoms of root suffocation from too frequent watering are the same as those for earth fill and natural gas leaks. The leaves turn yellow, the discoloration is generalized, and there are no rapid gradations between the different colors seen on the leaves.

The symptoms from salt vary somewhat between plant species, but the peripheral scorch is quite characteristic. There is some variation between geographical regions. If saline irrigation water is applied after the leaves have reached full size in the spring where rainwater permitted full size growth, a grey or brown perimeter scorch with a definite edge on the discolored part develops.

This sharp edged peripheral burn usually has a dark line along the edge of the scorched area in Texas. Michigan chloride injury from snow melting salt has a similar distribution of scorched area on the leaf, but the color change is more gradual and there is more yellow between the brown and green areas. In Texas, leaves formed after the irrigation season starts are often dwarfed. No such dwarfing was seen in about 20 comparitive samples of Michigan leaves.

The high chloride content leaves were the same size as the symptomless check leaves which contained no measurable chloride. High chloride contents in leaves do not persist through periods of high rainfall in Texas.

The sycamore illustrated (on page 16) had chloride injured leaves through a drouth period, but the subsequently formed leaves in a rainy period were symptomless. Where winged elms and cedar elms are mixed with native live and post oaks, the elms die first when saline water irrigation is the problem. The resistance that live oaks have to salt seems to be a resistance to the uptake of the salt in the water by the roots of the tree. The elm leaves in a mixed stand always have much higher salt contents, but both elms and oaks start showing necrotic symptoms when the choride reaches 3,000 ppm in the leaves. Other species that are susceptible to salt and thus are good indicators of salt problems are sycamores, American elms, maples, ginkgo, sweet gum, and American holly. Yaupon, citrus, live oak, Chinese holly, Chinese tallow, and yuccas are among some of the more salt resistant trees.

Where there is a continuous source of saline water, such as by a leak in a water pipe, the leaves will often be dwarfed, even those that form in the spring. This can happen where the chloride levels in the leaves reach 1,000-2,000 ppm. Live oaks can develop thin crowns and dieback in addition to the dwarfed leaves where a continous source of saline water is available. Trees next to drainage-ways may get more salt than their neighbors.

Where there is an excess water problem on a lawn, the first symptom is often a yellowing of the leaves. This may indicate root suffocation, salt injury, or both. Next there are usually peripheral scorches present on the leaves from the salt. In cases where black alkali develops from excess sodium in the soil, in addition to the perimeter-scorch-chloride symptoms there will be dark brown discolorations. These dark brown discolorations have a sharply defined margin.

The damage and dieback of the trees takes a few years to develop. It usually starts in the center of the area to which the excess of water is being applied. The trees at the edge of the perched water pool live longer, since they have less root smothering and total water than those in the center. The effects of the alkali from the sodium build-up also seem to be worst in the center of the perched water pool. The alkali build-up is indicated by pH's above 8.3 in soil tests (The highest pH calcium can

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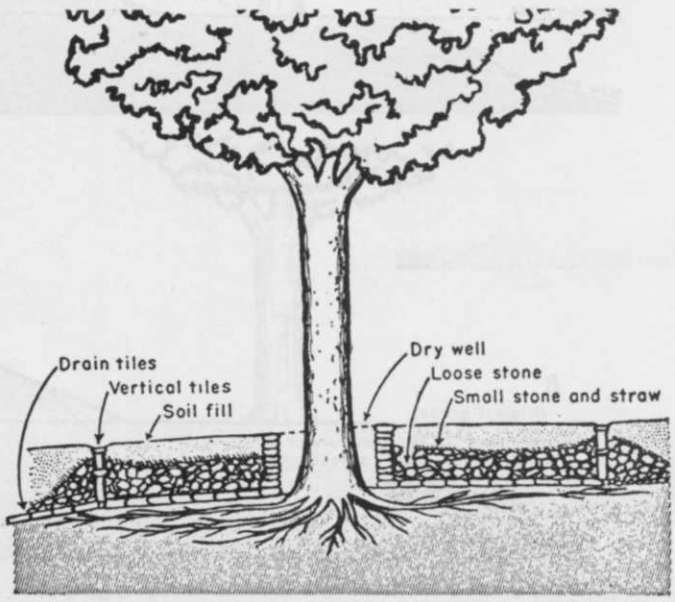

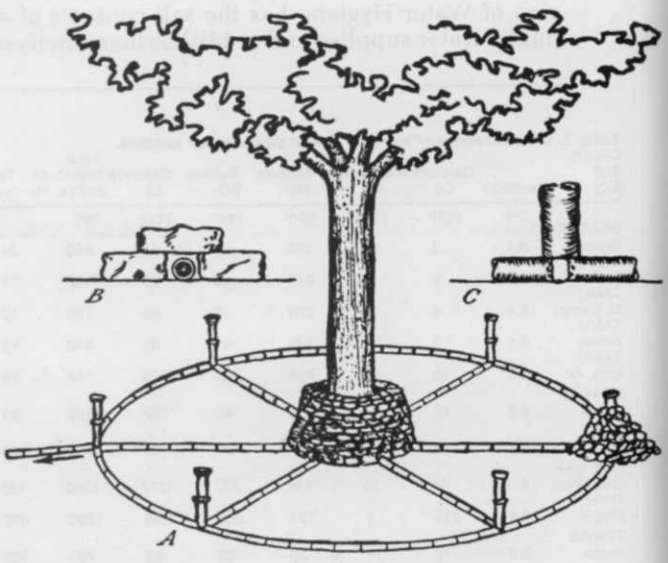

Completed dry well and fill cross section (left). Construction layout prior to filling (right). Tiles on ground are sloped away from trunk and roots. Vertical tiles permit additional air circulation. Stones around tiles provide support during fill placement.

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In the eyes of many Golf Superintendents it reigns supreme among the turf-type ryegrasses today. Why? Because it performs! And a Superintendent knows that claims are great, but performance counts.

- Consistently performs better than other leading varieties from California to Florida
- Durable, dark green and has excellent mowing qualities
- Tolerates a variety of soils & responds rapidly to fertilization
- Germinates in a week (or even less) under ideal conditions
- Better-than-average heat and drought tolerance
- An adaptable and disease resistant cool-season turf grass
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- Thrives when close-cut

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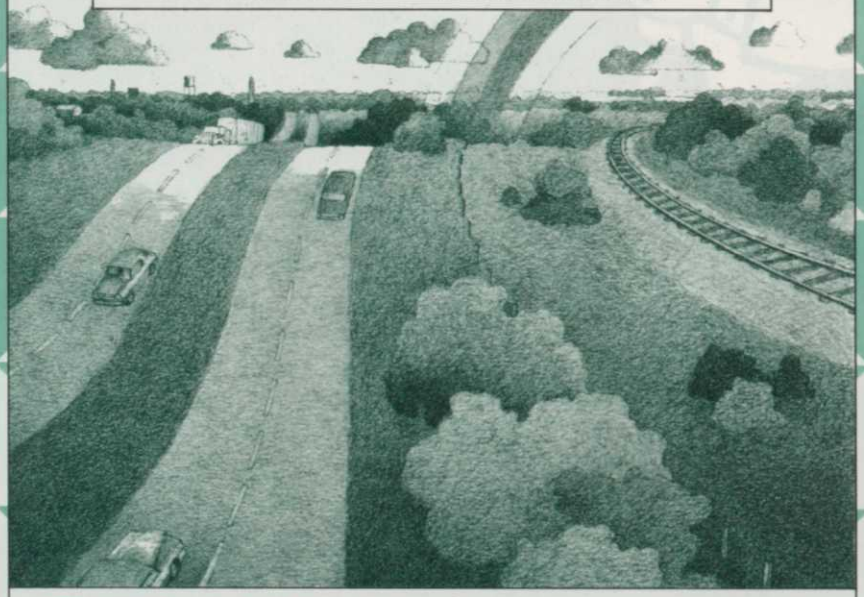

GENERAL NON-SELECTIVE HERBICIDES

For general post-emergent weed control in non-crop areas Crystal Chemical Company makes Phytar 560 and Broadside. Both are Cacodylic Acid type herbicides, and Broadside also contains MSMA. Both products can be used for fast knockdown of weeds along highways, rights-of-way, around buildings, fence rows, playgrounds, drainage ditches, golf courses, and railways. Phytar 560 is safe for use around ornamentals and non-bearing citrus orchards, while Broadside's effective root-kill is ideal for controlling tough perennials. Both provide complete weed control without soil sterility. So don't let unsightly and hazardous weeds control you. Control them with Phytar 560 or Broadside.

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make without excess sodium is 8.3). When the high pH is noted, tests for sodium are in order. The alkali pool is commonly referred to as "black alkali"; the soil structure collapses into a gummy mass which adds physical problems to the chemical toxicity of the soil (Longenecker and Lyerly 1974, Richards 1954, and Barber 1964). A forest soils text (Wilde 1946) says that soils with pH's 8.1-8.5 are toxic to trees and cause dwarfing, and that trees can not grow in soils with a pH above 8.5.

Control of watering injuries

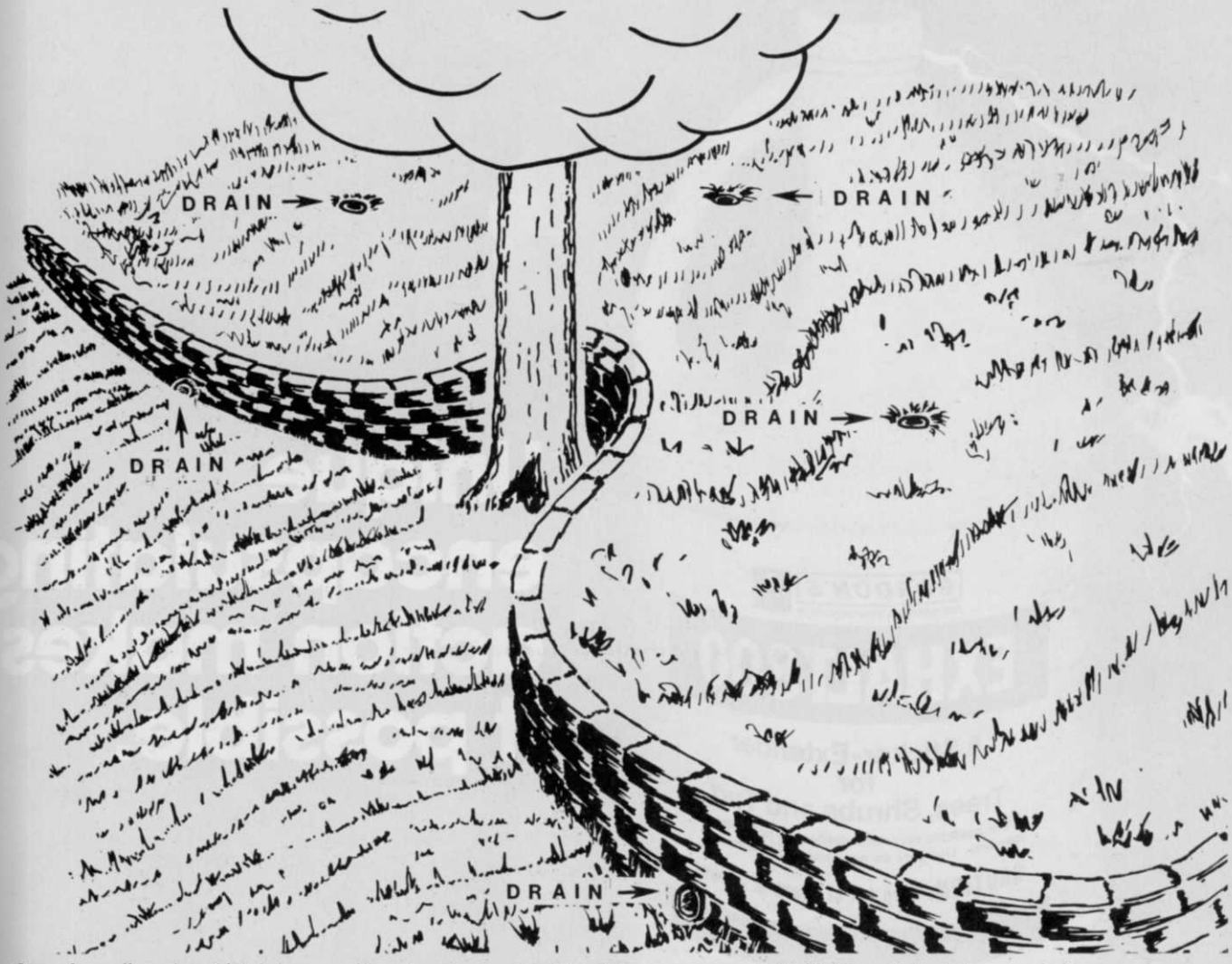
To control root smothering and salt from the irrigation of lawns, water no more often than once a week (every 10 or 12 days is better). Water at each setting to equal about 2 inches of rain, until there is run-off; the run-off insures the flushing out of any salt that has built up on the surface from evaporation. Mulches on the soil surface (gravel, pine bark, composted leaves, etc.) help reduce evaporation from the soil surface and should reduce water use. The less water used, the less salt is left behind as the water evaporates from the soil surface or the leaves. Allowing the soil to dry between each watering prevents root suffocation. A neighbor of mine in Bryan only waters two or three times a year, and sometimes less often; his grass is usually brown, but his trees are the healthiest in the neighborhood.

In more arid climates where watering must be done because trees can not survive without artificial watering, gypsum ($CaSO_4$) can be added to the soil. The sulfate neutralizes the alkali from the sodium. Sulfur can also be added to get the same effect, but the amount of water soluble salts in the soil can continue to build up and eventually give you salinity problems. Watering once every three weeks should keep live oaks and post oaks healthy. All fertilizers (in areas where water is high in sodium) should be in the form of sulfates. Fertilizer salts also add to the total salinity; therefore, fertilizer use should be restricted.

Excess Fertilizer

Fertilizing grass lawns to a lush green with more than 1,000 pounds of fertilizer per-acre-per-year,

Continues on page 26



Open dry well at edge of filled slope provides air and water circulation to the area covered with fill. The wall should be a few inches higher than the fill to prevent debris from washing into the well.

With Exhalt® 800 78% of your fungicide is still working even after a 2-inch rain...

Unique encapsulating action makes it possible.

Percentage of fungicide retained after rains, Exhalt 800 versus Brand X:

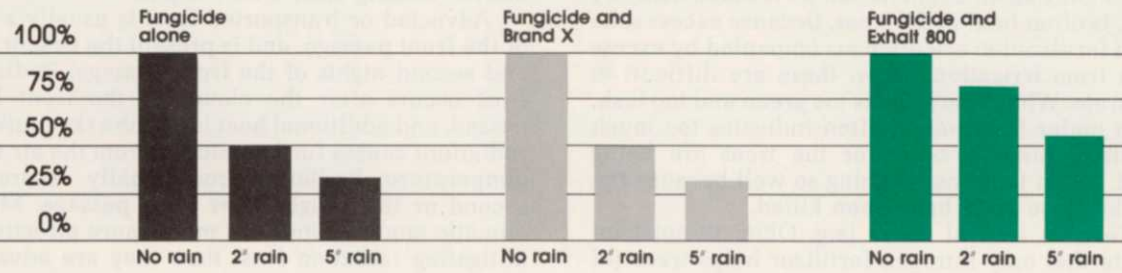


Chart shows how Exhalt 800 resisted wash-off in a laboratory test. Spray coatings were applied to glass panels and dried 10 minutes at approximately 70° F. Retention after erosion by rain was measured by solvent stripping the panels and determining the residual fungicide by quantitative ultraviolet spectroscopy.

See how Exhalt 800's encapsulating action guards against costly fungicide wash-off:

This test with Exhalt 800 shows 78% of fungicide was still intact after a 2-inch rain. Even after 5 inches of moisture, 60% was still in place.

We're painfully aware that you may be disenchanted with spreader-stickers, so we want to emphasize that Exhalt 800 is *not* a spreader-sticker. Rather it is a *Sticker-Extender,* and there's a world of difference!

The *spreader* part of a spreader-sticker is a detergent that actually assists in wash-off. Exhalt 800, on the other hand, has a unique encapsulating action that causes fungicide to *resist* wash-off.

Simply stated: Spreader-Stickers *assist* wash-off; Exhalt 800, a unique Sticker-Extender, *resists* wash-off.

Defies Rain

To illustrate its clinging power, let's suppose you have added Exhalt 800 to your fungicide and treated 18 greens. An hour later a dark, menacing cloud rolls in; in the next 45 minutes it dumps two inches of rain on your treated greens. What now?

Obviously, some of your treatment is washed away. But the silver lining is . . . *some 78% of it is still in place and working.* Thanks to Exhalt 800's unique encapsulating power, you won't have to repeat the whole costly process again tomorrow.

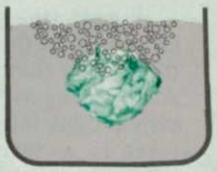
Even in arid regions plagued with occasional fungus flare-up, Exhalt 800 pays. It lets you spray and, after an hour, irrigate. With no more worry about losing your greens to either fungus or drought.

The Exhalt 800 difference

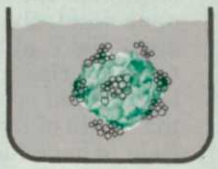
Unlike spreader-stickers that wash off with the first rain, Exhalt 800 (a sticker-extender) clings with encapsulating power. It's an extremely sticky, flexible, fabric-like protector that encases every fungicide particle, keeping it in place and working despite rainfall.

A closer look at Exhalt 800's unique encapsulating action:

One miniscule fungicide particle, greatly magnified. Countless millions of such particles in water become the spray solution.



Exhalt 800 enters spray tank. Hydrophobic (repelled by water), it breaks into myriad of tiny droplets and attaches to fungicide.



Tiny Exhalt 800 droplets form a porous "fabric" that encapsulates every fungicide particle, causing it to cling to turf or foliage.

To get a clear picture of Exhalt 800's superiority, study the chart above. This test, important though it is, is just one of many. Our files hold much other massive evidence of Exhalt 800's unique encapsulating power: the field-test data from many leading universities (test results available on request).

While Exhalt 800 is used extensively on turf, it also is registered for use with insecticides for trees and ornamental shrubs. In every use, it lets plants "breathe," grow and develop normally. It's economical and easy to use.

Exhalt 800 is effective with most brands of wettable-powder and flowable fungicides, including Gordon's Dymec 50™, Formec 80™, and Topmec 70W™.

Try Exhalt 800 now

The evidence is clear and overwhelming — Exhalt 800 doesn't cost, it pays. Don't you owe it to yourself and your greens committees to give it a trial? One gallon will prove it to you. If your distributor doesn't have Exhalt 800, or if he's out of reach, order a trial gallon direct from us. Send a check for $28, we'll rush a gallon postpaid. *Send to PBI/GORDON Corporation, P.O. Box 2276, Kansas City, Kansas 66110.*

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on claypan or caliche soils in semi-arid areas where only small amounts can be leached away by rain, is often fatal to the trees. Because excess salts from fertilization are often accompanied by excess salts from irrigation water, these are difficult to separate. Where the grass is too green and too lush, even under the trees, it often indicates too much fertilizer (and/or salts) for the trees are being used. Often the grass is doing so well because the shallow tree roots have been killed.

Tests in several states (e.g. Ohio, Illinois) indicate that only nitrogen fertilizer helps trees (of the three principal nutrients). Phosphorus may help rooting on new transplants, and phosphorus may increase flowering. However, woody plants through their mycorrhizae can absorb phosphorus not available to crop plants, and its lack does not limit tree growth. Almost all Texas soils have an excess of potassium. It should not be added.

As a general rule, fertilizer applications should not exceed 435 lb./acre/year, or 10 lb./1,000 sq. ft./yr.

Deficiencies

In alkaline soils zinc and iron may be deficient in the trees even with an adequate supply in the soil. They may have to be added by foliar sprays to the trees. Foliage sprays of ½ percent solutions of iron and zinc sulphate can make the trees greener.

Trees in the Gulf coastal plains soils can increase growth and leaf retention by adding magnesium. Foliage sprays of ½ percent $MgSO_4$ turn yellowish trees green, but trees so treated showed remarkable increases in growth when serpentine gravel was spread around their bases when compared to trees without the serpentine ($Mg_3Si_2O_7 \cdot 2\ H_2O$);(in Bryan). Dolomite gravel should also be effective. These soils in Bryan do not show Mg deficiency in the soil tests, but the addition of magnesium gives improved color and improved growth in perennial woody plants.

Damaging Weather

Abnormal weather often harms vegetation. Through cultivation we extend the ranges of plants into regions where normal weather has adverse effects. This cultivation makes our plants more susceptible to weather.

Frost

Frost is usually associated with the passage of cold fronts in the continental United States. The cold front is the leading edge of a mass of cold air advancing into a warmer region. Most of these air masses are Polar, Continental air advancing into areas that average warmer. (In America we tend to consider frost a temporary condition, and a freeze the more permanent; in Europe, frost is used in the more permanent and colder sense we would call a freeze.) These temporary chillings occur in the summer in the Lake States, in winter in the Gulf coastal plain, and in the spring and fall in the intermediate latitudes.

These cold air intrusions cannot persist in the warmer heat balance, so the temperature is usually above freezing after a few nights.

Advected or transported frost is usually a part of the front passage, and is present the first or first and second nights of the front passage. Radiation frost occurs after the clouds of the front have passed, and additional heat loss to the sky (outward radiation) causes further cooling from the air mass temperature. Radiation frost usually occurs the second or third night after front passage. Microclimatic modifications are much more effective in mitigating radiation frost than they are advected frost.

Advected frost

In a forested region, nocturnal winds are much reduced by the roughness of the surface. The trees tend to protect against cold wind, and the heat stored in the tree bodies reradiates and tends to keep the trunk space (beneath the canopy) climate relatively warm. Therefore, the forest stand does protect against advected frost.

Radiation Frost

The trees are more effective as protectors against radiation frost (that frost produced by radiated heat loss on clear dry nights). In the northern hardwoods the temperature averages about 10°F warmer than in open field, but it may be as much as 15° warmer on a clear cold night.

In an oak stand in southern Wisconsin that I studied for three years, frost occurred 30-45 days later under the leaf canopy than it did in the open. In fact, it never frosted under the canopy until the trees were defoliated (Van Arsdel et al 1961).

Buildings are as good as trees at protecting against frost, heated buildings are better. Plants in courtyards or close to buildings receive protection from frost. The D:H ratios apply as well as they do in the forest.

Forest Openings

Forest trees greatly modify the local climate. Openings in the forest have special characteristics that make them helpful in preventing local frost. An opening with a diameter from crown edge to crown edge less than the height of the surrounding trees is as warm at night as under an unbroken crown canopy. This is from 1-5°C. warmer than an open field. By day it is probably cooler than an open field, although size and time of day have more precise effects on daytime temperatures. A larger sized opening, i.e. four times the diameter of the height of the trees, is about as likely as the open field to have radiation frost. Larger sized openings are more likely to have frost, smaller sized openings are less likely to have frost (Van Arsdel 1972).

Topographic effects

Topography has a major influence on radiation frost. Cold air flows downhill in layered flows at night something like water (with extra friction). Low places such as kettle holes fill with cold air, as do valleys. Cold air pools are often found at the

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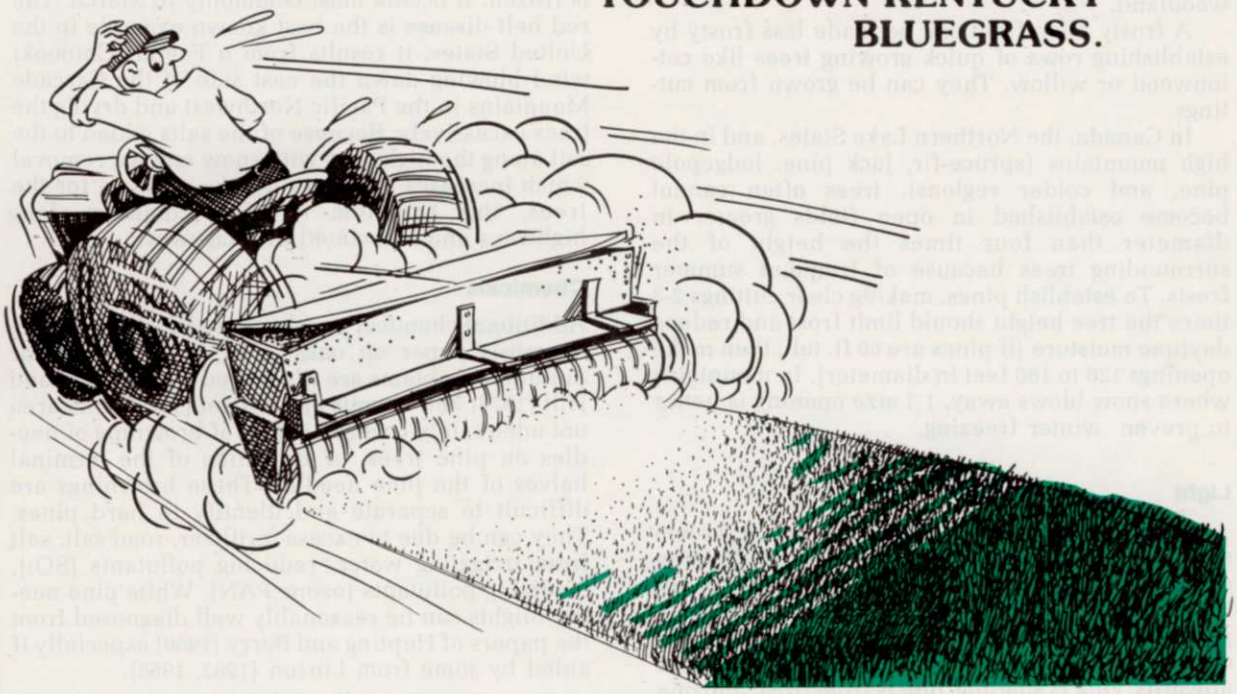

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bases of slopes or, on gentle slopes, on the uphill side of obstructions that make air dams. The cold air pools in valleys often turn into down valley winds, as the night progresses in mountainous or hill country.

Frost Control

Frost can be avoided in plantations by locating young trees on warm shoulders. After these trees have grown up it is possible to advance your forest edge from the established trees as the frost danger is reduced at the crown edge (Geiger 1965, Van Arsdel 1972).

More frost susceptible trees can be grown in small openings or strips less than 1:1: D:H ratio, when they are being established in an old forest or woodland.

A frosty open field can be made less frosty by establishing rows of quick growing trees like cottonwood or willow. They can be grown from cuttings.

In Canada, the Northern Lake States, and in the high mountains (spruce-fir, jack pine, lodgepole pine, and colder regions), trees often cannot become established in open fields greater in diameter than four times the height of the surrounding trees because of frequent summer frosts. To establish pines, making clear cuttings 2-3 times the tree height should limit frost and reduce daytime moisture (if pines are 60 ft. tall, then make openings 120 to 180 feet in diameter). In mountains where snow blows away, 1:1 size opening is better to prevent winter freezing.

Light

Light limits tree growth whenever a crown shades trees beneath. A common shade tree complaint for pines is "the lower branches are turning brown and dying." Remember this when you diagnose shade tree problems. There are three common maladies in which the death progresses upwards. One is shading, one is from frost, and one is from rain splashed pathogens, such as Elytroderma needle cast of ponderosa pine.

In the forest we speak of a lack-of-light injury as shade tolerance. Trees of an intolerant species are shaded out as crowns of faster growing trees close over them. The usual symptoms are browning and dying, but often the tree just produces fewer and fewer leaves until it gets below the critical level.

Turner and Aulitzky report that low light from clouds on the northern slopes of the Alps restrict tree growth in central Europe. Tolerant trees such as spruce and fir do better in such fog belts. (Hempel, 1961).

Lignting

The long slash up the cambium spiralling down a tree where a one to four inch wide strip of bark has been ripped off is a common symptom of lightning injury. Near the base of the tree large long splinters of wood are often shattered out. Sometimes the whole tree is shattered. Some large trees are protected by lightning rods.

Drought

The symptoms for drought injury are similar to wilt diseases and changes in grade (defoliation, resprout on hardwoods). True drought symptoms must occur, but often local drought killing reports have turned out to be a fungus wilt disease (Oak wilt, Cephalosporium wilt of live oak) or other problems. Many reports of drought or scorch look like salt toxicity to me, and I wonder if the authors checked the salt content of the leaves (Tattar 1978). The symptoms that occur on unwatered potted plants do not have the predictable symptoms that some of the other described maladies do.

Winter kill or winter injury is often a reddening (or browning) of conifer needles on the part of the tree exposed to a hot drying wind when the ground is frozen. It occurs most commonly in March. The red belt disease is the best known example in the United States, it results from a Foehn (Chinook) wind blowing down the east side of the Cascade Mountains in the Pacific Northwest and drying the trees excessively. Because of the salts added to the soil along the highways with snow and ice removal which increases the water uptake problem for the trees, this symptom is more common along highways and associated drainageways.

Chemicals

Additional chemical problems are illustrated in my diagnosis paper on oaks (Van Arsdel 1978). Air pollution problems are illustrated by Jacobson and Hill (1970) and Loomis and Padget (1975). One area not adequately covered is that of browning of needles on pine trees, or browning of the terminal halves of the pine needles. These brownings are difficult to separate and identify in hard pines. They can be due to excess fertilizer, road salt, salt from irrigating water, reducing pollutants (SO_2), oxidizing pollutants (ozone,PAN). White pine needle blights can be reasonably well diagnosed from the papers of Hepting and Berry (1960) especially if aided by some from Linzon (1962, 1965).

Browning of needles is a common reaction to various chemicals, but on pines there is no general rule to separate these. Among the air pollutants there are oxidizers and reducers. Some oxidizers come from photochemical reactions. Nitrous Oxide in sunlight releases ozone. Peroxy-acetyl-nitrate is a photochemical produced from unburned petroleum hydrocarbons from car exhaust. Ozone can also come from lightning or subsidence of the high atmospheric ozone layer.

Sulfur dioxide is a common reducer. There can be synergism between the oxidizers and reducers. As a protective reaction stomata usually close in the presence of oxidizers, but SO_2 can keep the stomata open for the oxidizers to get in. To help diagnose the problems of pollutants the sources must be investigated. As an aid to diagnosis it can be noted that ozone often comes from a single event that makes the injury cover much of the growth that was present at the time of the injury. Sulfur dioxide tends to be a slower accumulation phenomenon, more localized on the leaf or needle, and often repeated. On pine needles this can pro-

duce alternating bands of injured and healthy tissue. The sulfur dioxide injury generally does not appear early in the growing season, in fact Dr. Patton called it the Fourth-of-July disease near a Wisconsin paper mill, because the injury showed up at the same time each year.

The control for pollutants is to remove the source, raise the stack height, or to use resistant selections where possible. Often there is nothing you can do.

Conclusion

Environmental diseases are common and becoming more common as man increases his numbers and his activities. Often there is little you can do about them, and prevention is usually easier than curing them. Much can be done to prevent construction injury; therefore, we need to find a way to motivate the builders. Irrigation problems, including saline irrigation water damage, can usually be solved by the homeowner. Road-de-icing-salt is a more difficult problem. Some care in the handling of salty snow can help, but in many cases the only solution may be mass political action. Frost, sunscald, and certain other environmental problems can be reduced with proper practices. Air pollution is a legal and political problem for the most part, and these must be used to modify the sources. Identifying the problems can help solve some environmental diseases, others may take long slow political action by concerned citizens.

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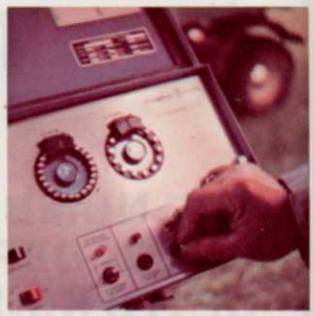

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DETECTION AND CORRECTION OF TREE ROOT DISORDERS

By Michael J. Walterscheidt, Ph.D.

To understand the problems of root suffocation, strangulation and surface rooting, it is necessary to know a little about the function and purpose of roots for a tree or other plant.

Most of the water absorbed by trees enters through their roots. This process of water absorption is dependent on several factors including the diffusion pressure in the tree, the efficiency of the root system and availability of soil moisture.

The root is also responsible for absorption of nutrients from the soil, which are found in the form of salts and are absorbed by the intimate contact of roots with soil solutions. The availability of these salts to the plant root can depend on several factors such as pH, concentrations of the salts and soil aeration.

Another function of roots is to conduct the absorbed water and nutrients to the stem of the tree where they are distributed to other parts of the tree. The conducting tissue is also necessary to move the manufactured plant foods downward to the roots. This downward movement of plant foods leads to another function of roots: the storage of carbohydrates.

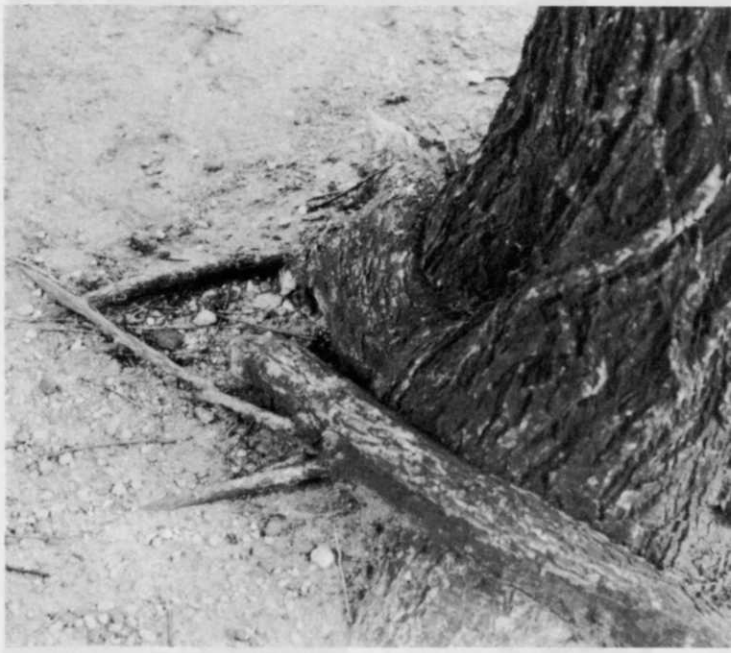
An additional important function of roots is the anchorage of trees. Through their close contact with soil the roots permit a large tree to remain standing during severe environmental conditions.

Now that we have noted the four primary functions of roots: absorption, conduction, storage and anchorage, let's look at various problems which can hamper one or more of these functions and cause symptoms which are exhibited by the upper portion of the tree, the part we see most often. It has been estimated that over half of tree problems are directly related to roots, yet these are the most difficult to diagnose. A little knowledge of some of the basic root problems and possible corrective action may allow you to "save" some trees which are in a state of decline.

Girdling Roots

Girdling roots of trees are a problem that has received considerable attention in recent years. Quite often decline in the upper portions of trees can be attributed to the presence of girdling roots on a tree. Smaller leaf size, leaf scorch, twig dieback and even the death of large branches can result from this type of root damage.

The cause of girdling roots is not always known. It is suspected that quite often girdling roots result from poor planting of trees. If the planting hole is too small a tree can be twisted slightly in a corkscrew fashion and most of the roots will then fit into the hole. Unfortunately most of the roots will also then be growing in a circular fashion often twisted around one another. As the tree grows and the roots enlarge they tend to crow the stem of the tree. This enlargement often causes one root to girdle or restrict the flow in the conducting tissues of the root, hence a portion of the tree may suffer due



Girdling roots on surface (top) and dieback (bottom) are two of the more obvious indications of root problems.

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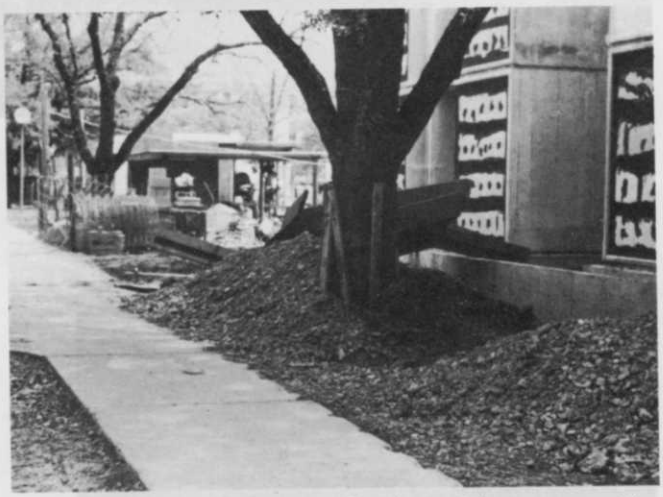

Trunk protection cannot offset the root damage caused by sidewalk and foundation construction. Dieback is already evident before construction is completed.

to this restriction. The symptoms are usually not expressed until the tree is quite large, perhaps 10 inches caliper, because it takes this long for the roots to enlarge enough to grow into one another.

Reasons other than poor planting may lead to girdling roots. Root injury due to soil compaction, paving or other factors may cause a proliferation of roots near the trunk of the tree and as they enlarge and compete for space they may girdle one another.

Girdling roots on the surface are relatively easy to detect and correct. The root can be seen growing around the trunk of the tree or across a large lateral root at the base of the tree. Quite often removal of the girdling root with a hammer and chisel will allow further development of the root that was girdled and perhaps a decrease in the decline symptoms of the tree crown. Removal of the girdling root should not be done however just because it appears to be a girdling root.

Girdling roots which occur below ground level are usually difficult to diagnose. Often they are first noticed by decline in the above ground portions of the tree, which is difficult to attribute to construction, paving or other detrimental factors. The best indication of below ground girdling roots is the presence of the telephone pole effect. Normally a tree flares at the point it enters the soil, but often a below ground girdling root will disrupt this flare and the tree will look like a pole. In some cases, the tree will be narrower at ground level than it is a short distance above ground. Usually the lack of root flare will be present on only one side of the trunk.

Below ground girdling roots have been removed with success in some instances. If a tree is rapidly declining and a below ground girdling root is found it probably should be removed. A mallet and chisel can be used to cut the girdling root on both sides of the restricted root and then it should be removed. Wound paint should be applied to the cut ends prior to refilling with dirt.

Girdling roots should not be removed as a matter of routine tree care. Only if there are symptoms in the crown of the tree should they be removed, and only then after considerations are given to other factors that may be causing the symptoms. If in doubt a competent diagnostician should be called in.

Surface Roots

Surface roots can become a problem in some tree species, especially several of the elms, silver poplar and Chinese tallow. Surface rooting seldom is directly harmful to the tree but can cause maintenance problems when the roots appear above the surface of the soil. When turf areas are well manicured the surface roots may be a hindrance to mowing. Likewise the aesthetics of a well manicured lawn can be destroyed by abundant surface rooting. If all the roots of the tree are near the surface the tree could be subject to windthrow during storms.

Many people attempt to remedy surface rooting by cutting the roots close to the tree and removing them. This should be done with extreme care because if too many roots are removed it could be detrimental to the health of the tree. The remaining root supply may not be able to provide the water and nutrients necessary to maintain the health and vigor of the tree. Also the cutting to too many roots could make the tree subject to windfall during a storm.

The most successful treatment of surface rooting is to spread sand to the level of the top of the root. If the roots are exposed to a great extent the top-dressing of sand should be done over a several year period. By carefully spreading the sand the soil level can be raised so the roots are once again underground. Do not attempt to indiscriminately place 4 inches or more or soil over the root surfaces completely around the tree as a remedy. This may result in suffocation of root systems and a decline or death of the tree.

Surface rooting can be caused by several factors some of which can be easily controlled and others which we have little control over. Frequent, light

watering of lawns under trees can cause an abundance of tree roots in the upper soil surface and may cause surface rooting. Improper fertilization can cause surface rooting, particularly when combined with the light watering. Heavy fertilization combined with low rainfall and light watering will result in a concentration of the nutrients in the upper several inches of soil which allows for vigorous grass growth, but also may cause an abundance of tree roots very near the surface.

Oftentimes surface rooting may be caused by soil structure. A heavy, shallow claypan can result in a concentration of roots near the surface. Likewise, a high water table can cause tree roots to concentrate near the surface of the soil. These soil factors are often difficult to correct to an appreciable degree, but if the claypan is not too thick it can be fractured by compressed air. Sometimes better drainage of an area will allow tree roots to penetrate deeper in waterlogged soils.

Since most surface rooting problems occur on older established trees, the corrective action is sometimes difficult. Care must be taken to do nothing that would seriously damage the roots or the corrective action may destroy the tree. The best long range solution is to plant the proper species on the proper site. Sometimes we are forced to plant on adverse sites. Subsoiling methods to break up the claypan, installation of drainage tiles or hauling in of topsoil prior to planting should be considered for these adverse sites.

Construction Injury

Perhaps the most perplexing problems encountered by grounds managers are associated with construction injury. All too often a recently completed facility is turned over to the grounds maintenance supervisor for care and during the next several years many of the trees on the site begin to decline and die. Some of the problems may not be evident for 3 years or more after a facility is completed. Seemingly there is no logical explanation because all of the trees were "protected" during construction. There are no scrapes or bruises on any of the trees, so equipment was kept away from the trunk. Problems of this kind can often cast a doubt on the management's minds about the grounds maintenance supervisor's abilities. After all, the management saw how well the trees were protected during construction.

Most individuals do not realize that just keeping the equipment away from the trunks of trees is not enough. Most of the damage occurs when heavy equipment and trucks run over the root systems of trees and compact the soils. Studies have shown that one trip across wet soil with a heavy tractor can reduce the infiltration rate 80%. Heavily compacted soils may become impervious to rainfall and the tree will then suffer from oxygen starvation and also from drought.

Quite often the roots of trees are severed when foundations of buildings are dug, when sidewalks are prepared, when utilities are brought into the site or when grading is done around the site. Often this root damage is quickly covered again, if severe enough the tree will die suddenly or begin a typical decline.

Much of the damage due to construction can be avoided. First, however, one must realize that if a building is constructed in a heavily wooded area the loss of some trees is unavoidable. A common mistake often made is to remove all the small trees and leave a few large mature trees. This is not always the best method because these mature trees will likely be more susceptible to construction injury than younger vigorous trees. Obviously all trees on the actual building site may be removed. Also trees that are located just a few inches from the foundation of a building are difficult to save. It can be much less expensive to remove these trees during construction than after the building is completed. In some cases the building placement can be changed to spare a valuable tree or group of trees.

Underground utilities often cut many tree roots and cause a decline in nearby trees.

Several actions can be taken on sites where the grounds supervisor has control prior to any construction activities. All trees located close to the site should be fertilized with a low nitrogen, high phosphorous fertilizer. This will stimulate root growth and have the tree in as healthy condition as possible. On these trees where there will be certain root damage the tops should be thinned out to compensate for the root loss. Care should be taken not to have the soil too wet prior to construction because wet soils tend to compact more easily than dry soils. A heavy mulch of chipped tree trimmings spread over the site will help prevent severe soil compaction.

Unfortunately grounds supervisors are not often hired until after a project is completed and most of the root damage is done. If trees situated near newly constructed areas show a lack of vigor or decline while nearby trees look healthy there is a good chance the decline is due to root injury. Some corrective action can be taken. A thinning of the crown of the tree coupled with a fertilization of the roots may help the tree recover. If, however, the root damage was severe even this action may not help.

Be alert to discover declining trees early. The sooner corrective action is taken the more likely the tree will survive. Things to look for include a

Poor drainage around construction areas can be very damaging to trees.

shortening of the nodes, i.e. shorter twig growth each year; smaller leaves than nearby trees of the same species; and off-color leaves, generally a yellowing. Oftentimes trees with root damage will exhibit a thin crown and gradual branch dieback. If these symptoms are noticed early and corrective action taken the tree may be saved. It must be remembered that any corrective action taken is generally much less expensive than removal of a dead tree and replacement with a new tree.

Soil fill around trees can be as deadly as cutting the roots. Decline of the tree can be rather fast or it may take a period of years. Soil fill symptoms generally resemble other root problems such as smaller leaves, reduced twig growth and top dieback. Soil fill is often relatively easy to detect by a trained individual because of the absence of root flare around the entire base of the tree. Quite often the depth of the fill can be ascertained by careful digging through the soil until a definite, sharp change in color is noticed. As little as 3 to 4 inches of fill can be damaging to some trees. Heavy clay fill generally is more damaging than sandy fills.

Corrective action for trees recently filled around consists of thinning of the crown and fertilization. If the fill is shallow the soil can be periodically broken up and fertilizer and water added, which encourages root growth into the filled area. If the fill is moderately deep the soil should be removed from around the trunk and a well formed. Holes should be made into the root zone every few feet and tiles placed vertically into them to allow air exchange at the original soil level. If a deep fill is made the well should be constructed around the trunk of the tree and then trenches dug radiating out from the well around the tree out to the drip line. These trenches should have 6 inches of coarse gravel placed in them, and a layer of straw placed on top of the gravel and then the soil refilled. A vertical tile should be placed at the end of each trench to allow air flow and the trenches should slope slightly away from the trunk for water drainage.

The best way to prevent fill damage is by taking preventive action prior to the fill if possible. Before the soil is placed around the tree a layer of coarse gravel should be placed in the area to be filled, then tiles can be laid in a radiating fashion around the tree to the drip line and vertical tiles placed at the ends. The coarse gravel should then be covered with a layer of straw to prevent the fill from clogging the spaces between the gravel. The soil fill can then be placed on the straw. A well is constructed around the tree which should allow good air circulation from the trunk through the coarse gravel to the vertical tiles. It would be wise to fertilize the tree prior to beginning the fill work.

A common type of root suffocation in developed areas is caused by paving. Quite often the paved area will go to within several feet of the trunk of large trees or in some cases within several inches of the trunk. When paving covers the roots of trees there is a severe disruption of the normal air exchange. The oxygen concentration of the soil air is reduced from a normal 18% to 3% and the carbon dioxide level is rapidly increased. Roots need the oxygen for respiration and therefore they die and soon the tree dies or declines. If paving is necessary it is often better to save a grouping of vegetation than to leave individual trees scattered in an area such as a parking lot. If paving close to a tree is unavoidable, an aeration system can be placed under the paving with perforated plastic pipe connected to vertical pipes at the edge of the paving. The paving must be put on grade level; no grading and damaging of roots should be done.

Most of the problems associated with declining trees can be attributed to root disturbances. Roots of trees are the most susceptible portion to injury during construction. They are not readily visible hence they are easy to ignore. Roots of trees need to be given the proper care especially on large trees because their root systems may spread over a very much larger area than most people believe. If tree roots are properly cared for the tree will be more vigorous and therefore be more likely to survive many of the other problems it encounters.

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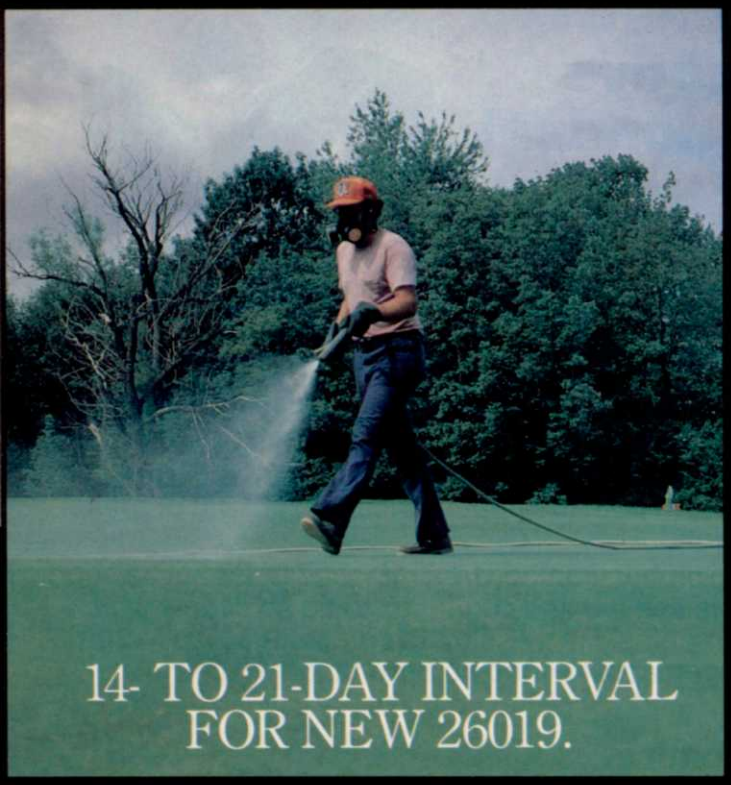

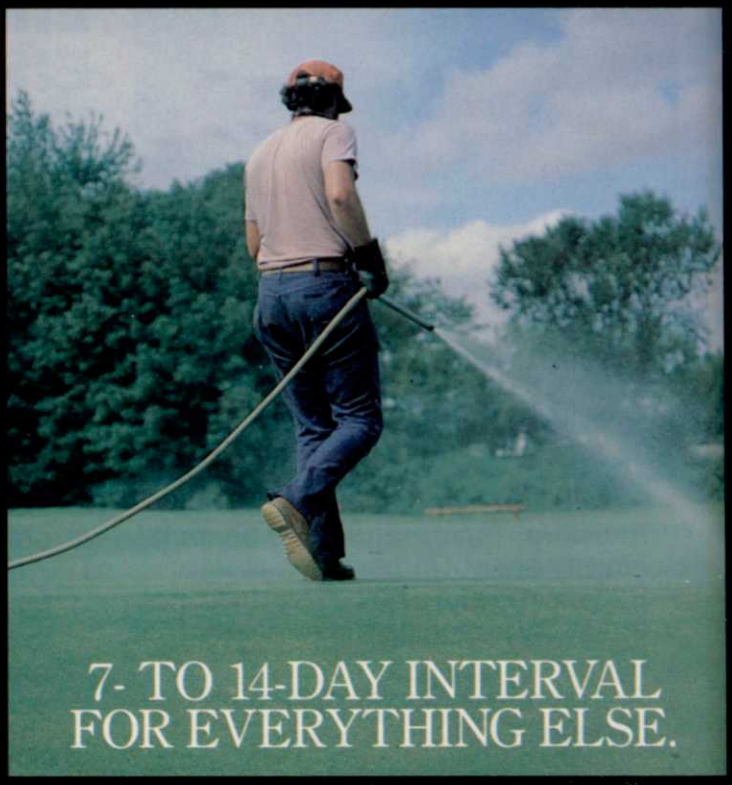

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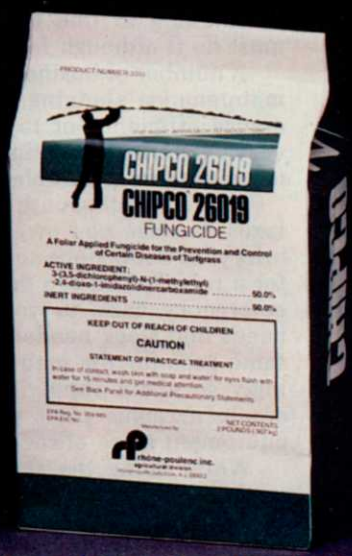
—Bob Dickison, golf course superintendent
Upper Montclair Country Club, Clifton, N.J.

"I feel very good about this product. We tested it during one of the roughest summers in my memory. I think, over a 14-day period in August, we had very close to 10 inches of rain. It was an acid test for the material. These chemicals come and go, and some of them are short-lived. But you folks have something good here. The sprayability of Chipco 26019 is very impressive. And you only need six to 10 hours of drying time, which helps a lot during rainy periods. Some other materials require at least 12 hours."

—Paul Boizelle, golf course superintendent,
and John Fenwick, foreman,
Fiddler's Elbow Country Club, Far Hills, N.J.

"We started using Chipco 26019 in June of 1977. Before we started using it, we had very little luck with our other contact and systemic fungicides in certain areas. We were applying some contact fungicides at preventative and curative rates, and still only getting two or three days control, with the usual cold fronts coming through, followed by large outbreaks of dollar spot. Since we started using Chipco 26019, we haven't found dollar spots in these areas at all."

—Randy Wahler, golf course superintendent
Glen Flora Golf Course, Waukegan, Ill.



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MAKING THE MOST OF EQUIPMENT MAINTENANCE

By Bruce F. Shank, Editor

Loan institution advertising on television points out that once you get caught up on bills, someone in the family gets sick, or a storm damages your house, or your car needs EXPENSIVE REPAIR.

Maintaining complex pieces of machinery is a fear of the American public. It may be even a bigger fear of small businessmen who must maintain numbers of complex machines to provide a reliable service to customers.

Undeniably, regular maintenance prevents serious breakdowns in equipment. When a mower needs an oil change after each 25 hours of use, it is impractical to run to the equipment dealer everytime. The businessman must provide for certain levels of maintenance on his own and stock the parts required for such maintenance.

Also undeniable is the responsibility of the manufacturer to make replacement parts available to purchasers of his equipment for the purpose of regular maintenance. Keeping stock of every little component of every equipment model tends to be an inefficient and complicated task for manufacturers. Inefficiency many times leads to high prices to make repair part supply profitable or at least break even.

Combine the fear of breakdown by owners with the complexity of parts supply to the manufacturer and you get a less than perfect situation. Furthermore, companies manufacturing repair parts which can be substituted for original equipment parts add to the manufacturers woes.

That's not all. Many Green Industry markets such as mowing/maintenance, cemeteries, and nurseries are forced to customize machinery made for golf courses and parks to make it fit their requirements. These businessmen doubt the concern that equipment manufacturers have for their particular business.

The result is a situation similar to paying taxes or standing in line for license plates, everyone must do it although few enjoy it.

A number of businessmen derive pleasure from maintenance planning by developing a scheme to assure efficiency or to cut repair part costs. The very challenge of beating the odds can make maintenance more palatable.

It's like waiting until the last minute to pay your taxes because you owe the government, or planning your deductions ahead of time and filing early for a rebate. You can deal with repair parts on an emergency basis or you can predict repair part needs and stock needed parts ahead of time. The same goes for the manufacturer, he can begrudgingly go about supplying repair parts or he can create a repair parts program which makes his equipment more attractive to the buyer.

While doing the research for this article we mailed a letter to every equipment manufacturer in the Green Industry. It's obvious that the companies responding and mentioned in this article have pride in their repair programs. They are making an effort to improve the repair parts situation.

There are forty-five blades to sharpen on this gang mower, a true maintenance challenge.

Following are suggestions made by equipment manufacturers regarding what repair parts to stock and maintenance that can be handled by the user.

Engines

If you don't know how to repair anything else, you should learn the basics of engine maintenance. Changing points, timing, and adjusting the carburetor are necessary skills for anyone using mowers, spray equipment, edgers, and just about anything used in the Green Industry. Valve and ring work might be left to an engine specialist or dealer's repair department.

Basically, if kept clean for proper air cooling, tuned for correct operation, and religiously lubricated, an engine can last years.

Kohler Company's product service manager Paul Scholten has written numerous trade publication articles on small engine maintenance. He recommends the following service based upon hours of use:

Each Day
- check oil
- clean air intake screen
- use fresh fuel

Every 25 hours
- change oil (usually SAE 30)
- clean fuel filter
- clean air intake filter

Every 100 hours
- clean or replace spark plug, check gap (usually 025 in. for gasoline engines)

Every 500 hours
- check or replace points (gap usually .020 in.)

Dust or dry clippings from summer mowing should be cleaned from engine fins and air intake and not allowed to accumulate. The operator must be instructed as to his responsibility of engine maintenance.

Many distributors and manufacturers offer engine maintenance instruction. Each person operating a device with an engine should attend such sessions and learn to perform basic replacement and adjustment service. It is not true that point replacement takes alot of time. With a few simple tools to simplify flywheel removal, changing points and cleaning should take no more than half an hour.

There are three theories of maintenance, one is to have a maintenance staff doing just maintenance. The second is to assign responsibility for each piece of equipment to its primary user and train the user to perform maintenance. The third way is to send everything to the dealer for maintenance.

A maintenance staff is not the most efficient use of personnel for smaller firms. Dealers will tell you of workers coming to their parts departments for simple parts just to goof off. If recognized high repair parts are stocked and each operator is responsible for maintenance of his machine and given a half hour each day to perform maintenance, none has an excuse to goof off. Furthermore there should be a sense of pride in the condition of his equipment if he is a good employee.

As always, if you would like to pass on your experiences with equipment repair and maintenance write us and we'll publish your thoughts on the subject.

A basic list of parts to stock for engines:
plenty of good SAE 30 oil
spark plugs
fuel filter element
air filter element (to use while other is being cleaned)
set of points, condenser, and rocker arm with spring, shear pins for flywheel, ignition coil

Mowers

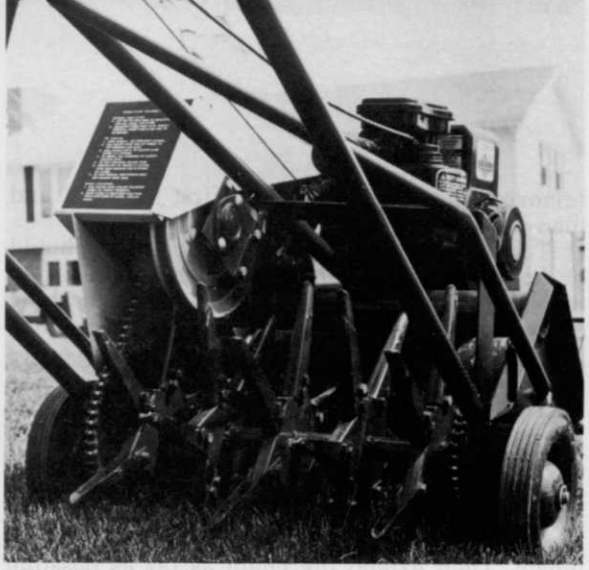
Roy Eldred, group director of parts for the Outdoor Products Group of Toro, recommends that turf managers stock the following "wear parts":

Walk Rotaries
- cutter bars
- belts
- collection bags
- oil

Riding Rotaries
- belts
- cutter bars
- filters for hydraulic equipment
- oil

Riding Reel Mowers
- bed knives
- bed knife screws
- belts
- oil
- filters for hydraulic equipment

Eldred says that stocking beyond these materials is wasteful and that operators should perform only that maintenance included in procedures described in the owner's manual.



Extra tines, drive belt, and core deflector should be stocked for aerifiers.

Eldred suggested that grinders, lapping machines, and blade balancers are useful additions to a maintenance department.

Sod Cutters

Ivan Vagts, Cushman-Ryan's national service manager, said sod cutters have very simple service needs. Vagts suggests owners stock one spare spark plug, a drive belt and one extra blade. He said the blade must be either 12- or 18-in. wide depending upon the model.

Aerifiers

Vagts recommends extra tines, one core deflector kit, a spark plug and drive belt for the Greensaire II. "Occasionally the tines will be damaged or break if they strike a rock underground," Vagts said. "But very little time will be lost if replacement tines are on hand since the job usually can be handled in less than five minutes."

Top Dressers

For top dressers Vagts suggests stocking connecting link assemblies and PTO roller chains. "If the link goes out the entire spreading operation can be shut down until another one is purchased," says Vagts. "I think an 80 cents investment in parts is a pretty good insurance policy."

Trucksters

Simple maintenance procedures such as oil changes help guard against field breakdowns of turf vehicles according to Vagts. Further protection can be achieved by stocking a set of points, a condenser, two extra spark plugs, an oil filter, an air cleaner element, and an alternator belt per vehicle. Special service charts are available for Cushman trucksters from Vagts, P.O. Box 82409, Lincoln, NEB, 68501.

Trenchers

Chains are the key to trencher maintenance beyond engine service. Maintenance should include checking chain tension, chain tooth wear, and using the right chain in the right circumstances.

Ditch Witch suggests lubricating chains between jobs to prolong chain life. If a chain is

removed and stored it should first be oiled and then hung in a dry place.

Tooth wear is fairly obvious and extras should be kept in stock. Chains are designed to sharpen themsleves, and good chains have tungsten carbide outer edges to keep the chains sharp and to prolong life. When this coating is worn off and the tip edges becomes dull, teeth should be replaced.

The chain overall can wear at the links. Ditch Witch suggests the chain be removed and measured to check free play between links. This free play should not exceed ½-in. per foot of chain length. The way to tell is to lay the chain on the floor, push the chain together, and measure the length. Then extend the chain as far as possible and measure again. The difference between measurements should not exceed ½-in. per foot, or an eight foot chain should not have more than four inches of free play.

A chain designed for standard soils should not be used in rocky soil. Special chains are available for frozen and rocky soil.

Regular lubrication of moving parts and rust prevention will extend the life of heavily used trenchers. Safety shields should be kept in good order and never removed. Heavy vibration of trenching equipment requires frequent tightening of bolts.

Ditch Witch offers a free brochure on chain care. The address is Ditch Witch, Charles Machine Works, P.O. Box 66, Perry, OK 73077.

Blowers

Carl Rinker, general manager of Atwater Strong, stresses, "With liability for injury today at an all time high, do it yourself repairmen quite often are their own worst enemy."

"We strongly recommend that major service or repairs on any of our equipment be handled by capable service dealers or distributors from which the equipment was purchased."

The key to a blower is the fan. Rinker suggests stocking of handle bars, fans and fan hubs. "Servicing of our equipment," says Rinker," should follow the service manual. The machine should be regularly oiled, greased where specified, and all fasteners should be kept tight. No safety guard provided on the equipment should be removed, permitted to deteriorate or become loose. Proper wrenches should be purchased for the fasteners on the equipment. Vice grips and pipe wrenches should not be used to remove fasteners."

Irrigation Equipment

An irrigation system is a carefully designed and balanced system. Changes to the original specifications should not be made without consulting the designer. Replacement parts must match the original specs. Rain Bird offers troubleshooting and design courses and has published four mainte-

Continues on page 61

Tools for Maintenance

Maintenance is more controlled if a place and set of tools are available. Harley-Davidson's golf car service manager Tom Falcone suggests the following materials for a maintenance department:

Spare Parts

1. Assortment of fasteners — cotter pins, washers, lock washers, bolts and nuts.
2. Ignition keys.
3. Lubricants — engine, differential and drive flange oils, a dry silicone or graphite lubricant.
4. Tire and wheel assemblies "spares".
5. Air cleaners.
6. Spark plugs.
7. Spare batteries, 12 volt for gas cars and 6 volt for electric cars.
8. Drive and generator belts

Tools

Available from numerous manufacturers for approximately $75 to $85. Tool sets should minimally include:

1. Screwdrivers (several sizes, including Phillips).
2. Pliers.
3. Needle nose pliers.
4. Vice grips.
5. 10" adjustable wrench.
6. Hacksaw and supply of blades.
7. ⅜" and ½" ratchet drives.
8. ⅜" and ½" breaker bars.
9. Sockets sets, ⅜" through 15/16", ⅜" and ½" drives.
10. Rubber hammer.
11. Brass hammer.
12. Set of open end wrenches, ⅜" through ¾".
13. Set screw keys.
14. Feeler gauge.
15. ⅜" electric drill and drill bits, 1/16" through ⅜".

Specialized Tools

1. Air compressor.
2. Battery load tester.
3. Cleaning solvents.
4. Compression gauge.
5. Grease gun.
6. High pressure washer.
7. Hydrometer.
8. Vehicle jack and jack stands.
9. Wheel chocks or blocks.
10. Log book — wall charts.
11. Low pressure tire gauge — 0 to 40 P.S.I.
12. Sensitive volt — ohmmeter.
13. Service and parts manuals.
14. Tachometer.
15. Towing device or trailor.

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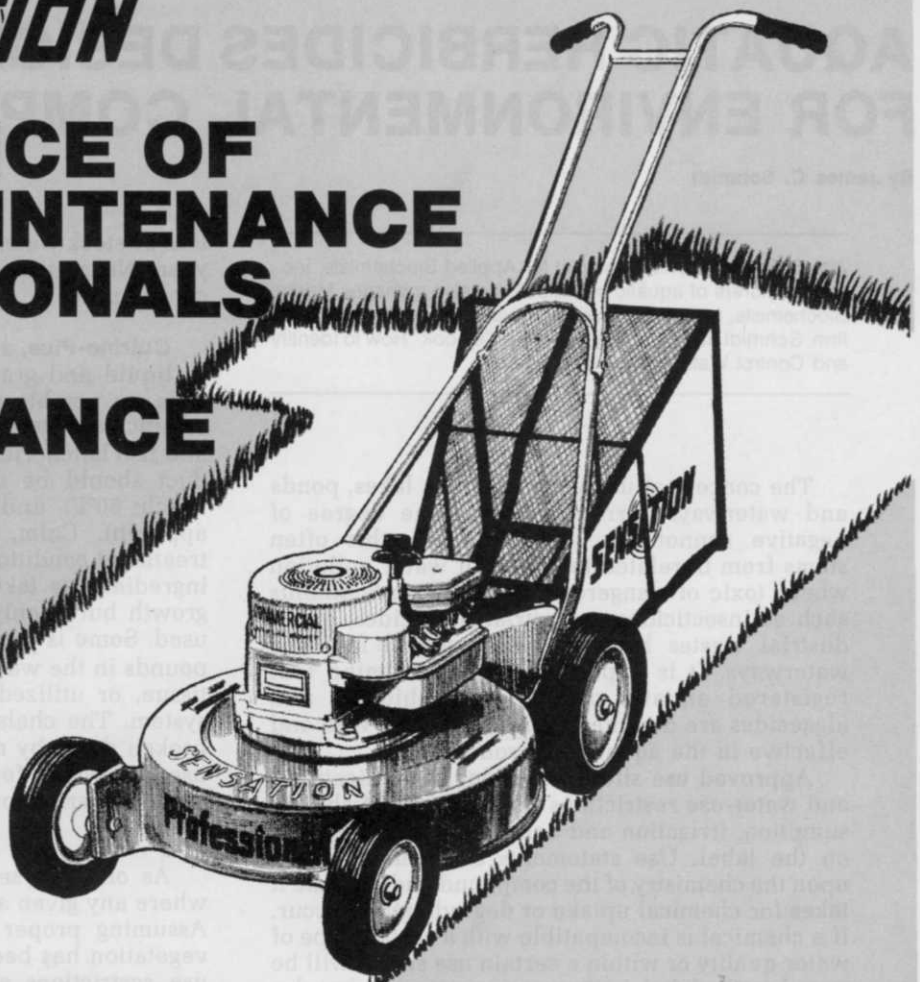

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AQUATIC HERBICIDES DESIGNED FOR ENVIRONMENTAL COMPATIBILITY

By James C. Schmidt

Jim Schmidt is Chief Biologist for Applied Biochemists, Inc., manufacturers of aquatic pesticides. He also manages Marine Biochemists, Inc., a commercial aquatic pesticide application firm. Schmidt has co-authored Applied's book "How to Identify and Control Water Weeds and Algae."

The concept of using chemicals in lakes, ponds and waterways carries with it some degree of negative connotation. Unfortunately, this often stems from unrelated incidents of water pollution where toxic or dangerous chemical contaminants such as insecticides, terrestrial herbicides, or industrial wastes have been introduced into our waterways. It is important to keep in mind that registered aquatic pesticides, herbicides and algaecides are designed to be compatible with and effective in the aquatic environment.

Approved use sites, conditions of applications, and water-use restrictions for swimming, fish consumption, irrigation and domestic use will appear on the label. Use statements are usually based upon the chemistry of the compound and the time it takes for chemical uptake or degradation to occur. If a chemical is incompatible with a certain type of water quality or within a certain use site, it will be stated on the label. Let's examine several examples of commonly used products:

Diquat, a liquid broad-range aquatic herbicide, specifically states on its label: "DO NOT USE IN MUDDY WATER." The active ingredient, diquat cation, is bound up by negatively charged, suspended soil particles. Besides that which is bound up by the sediments, it is further degraded through photodecomposition. Water use restrictions are in effect for 10 days following application.

Aquathol K, a liquid or granular contact killer for aquatic plant control, indicates on its label: "For best results, water temperature should be 65°F. or above." Microbial breakdown of the active ingredient occurs in soil and water. Following treatment, water should not be used for swimming for 24 hours; fish should not be consumed for 72 hours; and water should not be used for irrigating or domestic purposes for 7 days. There is no waiting period required for sprinkling bent grass, however.

Aquazine (Simazine), a wettable powder algaecide/herbicide formulation for pond use only, cautions on its label: "Do not treat ponds which have bordering trees with roots visibly extended into the water since injury to these trees may occur. Usually, trees 50 feet or more from the pond's edge will not be injured." Simazine is metabolized to simpler compounds by susceptible plants. Residual activity in certain pond bottom types does occur, therefore, treated water cannot be used for irrigation or stock watering purposes for a period of one year. No restrictions apply to swimming or fish consumption.

Cutrine-Plus, a broad-range algaecide available in liquid and granular formulations, lists its use sites as: potable water reservoirs; irrigation conveyance systems; farm, fish, and fire ponds; lakes; and fish hatcheries. The label advises that this product should be used when water temperatures reach 60°F. and algae growth first becomes apparent. Calm, sunny days provide optimum treatment conditions. Elemental copper, the active ingredient, is taken up by both weed and algae growth but is only toxic to the algae at the rates used. Some is rechelated by natural organic compounds in the water, lost to the sediments in plant tissue, or utilized as a micronutrient within the system. The chelating agents, ethanolamines, are broken down by microbes. There is no waiting to use the water for swimming, fishing, irrigating, stock watering or domestic purposes following treatment.

As one can see, there is some variability on where any given aquatic pesticide should be used. Assuming proper identification of the nuisance vegetation has been made, the use site and water use restrictions are important considerations in choosing between alternative chemicals.

The previously mentioned products are certainly not all the compounds available for aquatic weed control. Unfortunately, many chemicals which are not specifically labeled or designed for an aquatic use site do find their way into the water. Diuron (Karmex°), for example, is approved for treatment of irrigation and drainage canals. It should be incorporated into the soil, and the water above it cannot be used. Ornamental and fish ponds are not approved use sites and yet people have a tendency to stretch the label's clearances. Abuses like this can result in environmental damage, ineffective control and negative side-effects, giving all aquatic chemicals a bad name.

Following are some additional questions and concerns which arise in the debate over using aquatic herbicides and algaecides. The answers, although general, should provide some clarification to those confused over what they might expect following chemical application.

Death and decay of chemically treated vegetation usually occurs within two weeks following treatment. Discoloration, elongation, or drooping are signs of weakness and impending death. The physical action of wind and waves assist in breaking the plants apart. Microbes then take over in furthering the decomposition process. Since these

Continues on page 46

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microorganisms utilize oxygen, it is important that heavily infested areas be treated a portion at a time where fish are present. Nutrients contained in the decaying plant material are assimilated by the microorganisms and reutilized within the food chain. Occasionally, some algal growth may be initiated. This can be easily controlled with an algaecide. Eventually, a fine organic silt made up of dead cellular material settles on the bottom. If these plants were allowed to mature before treatment and died by natural causes, the amount of organic material added to the bottom would be greater and more seeds or reproductive structures would have been produced. Chemical treatment, therefore, can be viewed as a means to accelerate the death of nuisance plants.

Properly timed and applied, herbicide treatments will control a species of plant for an entire season. Since there is sometimes the threat of reinfestation from cuttings, unaffected seeds or underground reproductive structures, some late season touch-up work might be required. In addition, periodic algaecide treatments might be necessary (four to six weeks apart) during hot weather or runoff periods.

Weed and algae control is a seasonal maintenance requirement. Residual control from year-to-year should not be expected. Keep in mind that some aquatic plants are cyclical, having good and bad years. Species might change naturally within a body of water, requiring a change in chemical. Many times a late season "regrowth" is actually a new species which has invaded the area.

Control failures or apparent failures which do occur are often the result of one of the following reasons:

— Not reading the label or following directions
— Incorrect species identification and subsequent use of the wrong chemical
— Miscalculation of the treatment area size
— Poor weather or water conditions during or immediately following treatment
— Reinfestation by new weed species
— Treating too late or too early in the season
— Not compensating for water inflow in high turnover situations

With the chemical tools available, most nuisance plants are controllable with a little planning, investigation, and careful application. An understanding of the product's basic chemistry, knowledge of its mode of action, realization of water use restrictions, and familiarity with what to expect following treatment will be helpful in choosing and using proper aquatic chemicals to enhance the aesthetic and recreational quality of our waterways. **WTT**

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HEAT STRESS, NOT ANTHRACNOSE IS SCOURGE OF POA ANNUA

By Houston B. Couch
Professor of Plant Pathology, Department of Plant Pathology and Physiology, Virginia Polytechnic Institute and State University, Blacksburg, Virginia 24061.

The distribution of annual bluegrass is worldwide. A native of Europe, it is also found in North Africa, Northern Asia, Australia, North America, South America, and within the Arctic Circle. On the North American continent, it is found from Newfoundland and Labrador west to Alaska — and south to California and Florida. In the areas mentioned, it is a fact of life in both professionally managed and homeowner maintained stands of turf and lawn grasses. In these situations, its degree of acceptance ranges all the way from (i) it is a weed to be controlled, to (ii) it is a valuable, if not necessary, component of the existing turf, and, therefore, a species to be nurtured in such a manner that its tenure in the area will be a long one.

Those who consider annual bluegrass to be a weed point to its lack of persistence during periods of high air temperatures. The general approach to its culture from this school of thought is to "get rid of it before it dies and leaves the area in which it was growing a beautiful display of dirt."

In the past few years, there has been a significant effort put forth to support the view that annual bluegrass is an important component of the existing turfs in the temperate zones of North America. Furthermore, it is advocated that through certain management practices, its pattern of growth can be stabilized to the extent that it can be just as reliable, if not more so, than the commonly cultivated temperate zone turfgrasses. The major thrust of this thinking has been directed toward the control of anthracnose — the theory being that this particular disease is the primary cause of death of annual bluegrass during the summer months. Consequently, if anthracnose is controlled, and a prescribed fertilization and watering program is followed, annual bluegrass can be grown successfully during this time period (8, 9).

The purpose of this paper is to (i)) review the present state of knowledge of the patterns of growth of annual bluegrass under various management stresses and those from the physical environment, (ii) outline our present understanding of the nature of anthracnose as it occurs on annual bluegrass, and then, from this background, determine if we can unequivocally state whether or not the major contributing factor to the commonly occurring death of plants of this species during the warm summer months is heat, anthracnose, or varying combinations of these and other stress factors.

The Nature of Annual Bluegrass

Annual bluegrass is a hybrid between *Poa supina*, a creeping perennial that is commonly found in the mountainous regions of Central and Northern Europe, and *Poa infirma*, an upright growing annual that inhabits warm, low-lying areas of much of the Mediterranean region. Its growth pattern as a winter annual was recognized when it was given the botanical name *Poa annua* by the Swedish biologist Carl Linnaeus in 1743. It is usually self pollinated, but does cross pollinate. The hybrid nature of annual bluegrass, and its capacity to cross pollinate within the species, has given rise to a large number of subspecies (ssp.) that differ in their appearance, growth habit, and capacities to respond to various environmental stresses. To date, 48 district subspecies of annual bluegrass have been described, and it is highly possible that there are many more left to be described (4).

> "In reviewing the research information we now have there in not sufficient data to establish anthracnose as a major factor of annual bluegrass dying out. On the other hand, with the knowledge we have of the relative susceptibility of annual bluegrass to heat stress, it would seem reasonable to assume that of all the stress factors, on a year-to-year basis, high temperature is probably the most important.

Two commonly occurring subspecies of annual bluegrass are *Poa annua* ssp. *annua* and *Poa annua* ssp. *reptans*. The variant *Poa annua* ssp. *annua* has a tufted, bunch type of growth habit. Its root system is not as fibrous as that of *reptans* and it has fewer adventitious roots. Also, in comparison with *reptans*, it has fewer leaf and node numbers and less secondary tillers. The subspecies *annua*, however, is a higher producer of seed than is *reptans* (7).

Poa annua ssp. *reptans* is the variant most commonly found in close clipped, irrigated, high managed areas such as putting greens. Its growth habit is creeping. Rooting occurs at the nodes of prostrate tillers. The subspecies *reptans* is not shallow rooted. Rather, its root system is highly fibrous and its depth of rooting compares favorably with Kentucky bluegrass and bentgrass. Also, this particular variant compares favorably with other temperate zone grasses in its ability to root in

compacted soils. Furthermore, under close cut, irrigated turfgrass cultural conditions, it is capable of forming a dense, uniform quality of turf. If its ability to survive during the stress periods of either summer or winter seasons could be enhanced, it would add much to the stability of turf quality in many sections of North America.

The response of annual bluegrass to management and environmental stresses has been studied, and comparisons made with other temperate zone grass species growing under the same set of conditions. The specific factors that have been considered are: low temperature hardiness, response to high air temperatures, response to high and low soil temperatures, wilting tendency, submersion tolerance, response to soil moisture stress, tolerance to smog, shade adaptation, and wear and compaction tolerance.

In comparison with the other temperate zone grasses, the low temperature hardiness of annual bluegrass is intermediate. It is equal to that of creeping red fescue and tall fescue, and is more winter hardy than perennial ryegrass. However, it is more prone to low temperature kill than Kentucky bluegrass, creeping bentgrass, or colonial bentgrass (1). It has been found that the specific killing temperature varies between the seasons. In late fall, annual bluegrass will be killed from a 5-hour exposure to a soil temperature of -5°F, while in early spring, it is killed after a 5-hour exposure At + 5°F. Also when annual bluegrass is growing on poorly drained soil, it is much more prone to low temperature kill (2).

The basic growth pattern of annual bluegrass is directly related to soil temperature. At cool soil temperatures, the tillers grow horizontally, while at high soil temperatures, they grow more upright. Also, at high soil temperatures the amount of tillering is significantly reduced (5). The capacity of annual bluegrass to form a dense turf, then, decreases proportionately with corresponding increases in soil temperature.

The hybrid nature of annual bluegrass, and its capacity to cross pollinate within the species, has given rise to a large number of subspecies with different appearance, growth habits, and stress responses.

Another effect of increasing soil temperatures is a progressive reduction in the growth rate of the root system of annual bluegrass. When the soil temperatures reach 75°F, the root systems become thinner and change in color from white to light brown. When the temperature reaches 85°F, they become even thinner and take on a darker brown color. The root growth of creeping bentgrass, on the other hand, continues at the same rate throughout the soil temperature range of 60°-80°F. In comparison tests, it has been shown that Penncross roots grow faster in the 55°-85°F soil temperature range than do those of annual bluegrass (5). This means that at the higher soil temperatures, all other conditions being equal, the creeping bentgrasses have a distinct, competitive advantage over annual bluegrass.

At higher soil temperatures (75 to 85° F) creeping bentgrass has a distinct competitive advantage over annual bluegrass.

Variability exists both among and within the various subspecies of annual bluegrass in their capacity to withstand the stress of high air temperatures. In a study on the effect of a series of 95°F days and 65°F nights on the growth reduction of 'Baron' and 'Fylking' Kentucky bluegrass, 'Jamestown' red fescue, 8 selections of *Poa annua* ssp. *reptans*, and 1 selection of *Poa annua* ssp. *annua*, Duff (3) found that they could be grouped as follows: (i) 5 of the selections of *Poa annua* ssp. *reptans* ranked with the 2 varieties of Kentucky bluegrass as the most heat tolerant, (ii) the remaining 3 *reptans* selections ranked second in their resistance to high temperature stress, (iii) the selection of *Poa annua* ssp. *annua* tested ranked third in heat tolerance, but only slightly above (iv) the red fescue, which was fourth, and, therefore, the entry that showed the greatest degree of growth reduction due to high temperature stress.

Variability in susceptibility to high air temperature stress is also known to exist among certain varieties within the various species of temperate zone turfgrasses. However, when the total amplitude of the individual varietal responses within a species is taken into consideration, it has been found that it is valid to characterize individual species on the basis of their "collective" response. When annual bluegrass as a species, then, is ranked with the various temperate zone turfgrass species with respect to the collective capacity of its individual variants to withstand the stress of high air temperatures, it falls in the poorest grouping. Basically, its heat tolerance is equal to that of creeping red fescue and perennial ryegrass, and it is significantly inferior to tall fescue, the bentgrasses and Kentucky bluegrass (1).

In our laboratory, we have observed that high air temperature stress produces two types of leaf symptoms in annual bluegrass. Continued exposure of the plants to a daytime temperature of 95°F and a night temperature of 75°F produces a chronic symptom pattern. This is seen as a leaf tip dieback that begins as a light yellow color which gradually changes to brown and then becomes light tan to strawcolored. When the plants are given a short term exposure to higher temperatures, an

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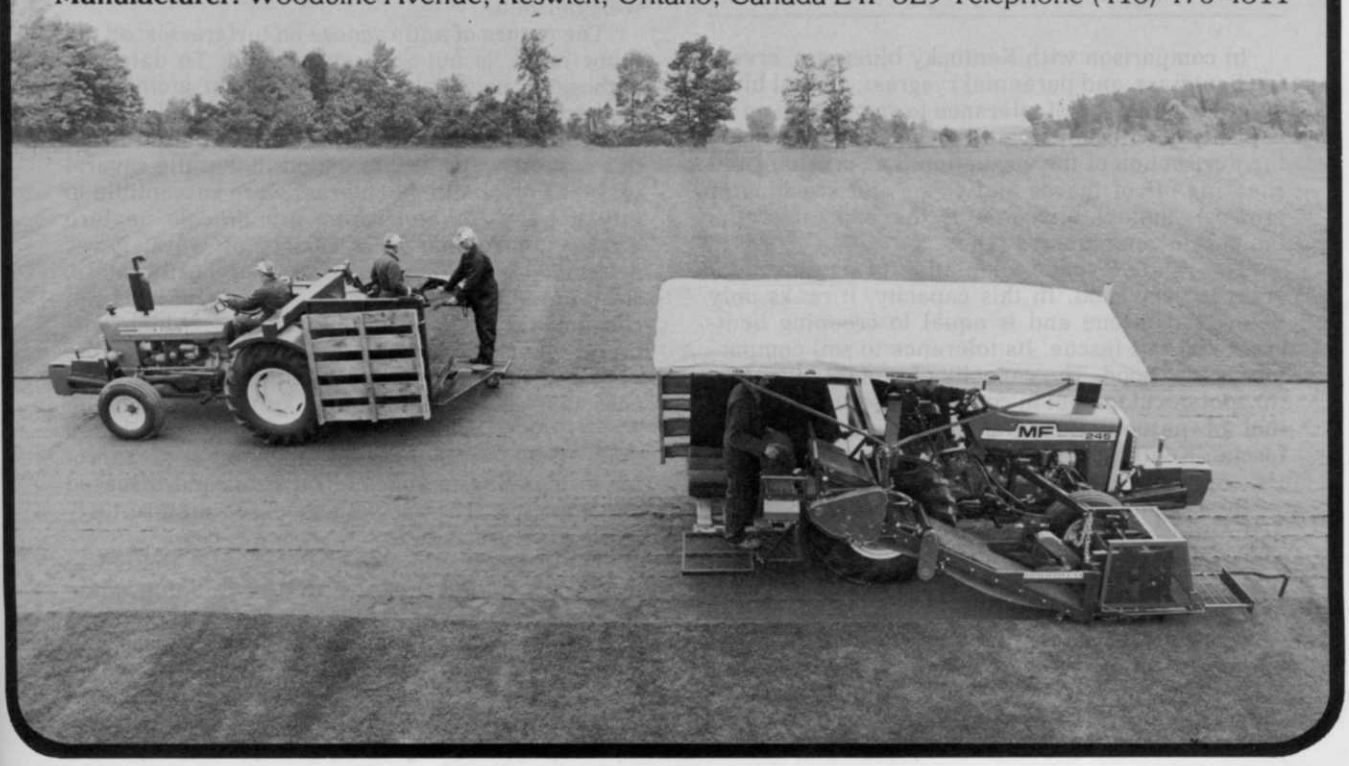

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acute symptom pattern develops. In these instances, the entire leaf first becomes dark green to purple, and then withers and fades to a light tan.

Annual bluegrass grown under high nitrogen fertilization is more prone to injury from high air temperature than when it is grown at low nitrogen (5, 6). Also, when annual bluegrass is under high nitrogen fertilization, it produces significantly fewer seed heads than plants under normal or low nitrogen nutrition (6). Nitrogen fertilization levels, then, are important factors in the capacity of annual bluegrass to survive high air temperature stresses within a given growing season, and to perpetuate itself from one season to the next.

Annual bluegrass does not compare favorably with other temperate zone grasses with respect to its tolerance to either excess or deficient soil moisture. Its submersion tolerance is better than that of red fescue and equal to perennial ryegrass. However, its capacity to survive extended periods of exposure to excess soil and free surface water is less than that of Kentucky bluegrass, tall fescue or creeping bentgrass. The wilting tendency of annual bluegrass is higher than red fescue, Kentucky bluegrass, creeping bentgrass, or perennial ryegrass (1). Also, the capacity of annual bluegrass to withstand periods of drought is less than any of the other temperate zone grasses (1, 11).

Annual bluegrass grown under high nitrogen fertilization is more prone to injury from high air temperature.

In comparison with Kentucky bluegrass, creeping bentgrass, and perennial ryegrass, annual bluegrass has the poorest tolerance to smog. Also, in its capacity to withstand the direct effects of traffic on the destruction of the vegetation (i.e., crushing and shearing off of leaves and stems and crushing of crowns), annual bluegrass is the poorest of the temperate zone grasses (1).

The relative shade adaptation of annual bluegrass is very good. In this capacity, it ranks only below red fescue and is equal to creeping bentgrass and tall fescue. Its tolerance to soil compaction is also good. The capacity of annual bluegrass for root development in compacted soils is equal to that of perennial ryegrass and better than red fescue, Kentucky bluegrass or creeping bentgrass (1).

By assigning a numerical value to each of the descriptive adjectives used above to compare relative responses to specific environmental stresses (i.e., excellent = 4, good = 3, fair = 2, poor = 1), and then calculating the sums of these values for each species, it is possible to rank annual bluegrass with other temperate zone grasses on the basis of its capacity to respond to the integrated stress effects of shade, smog, wilting, low soil water, excessive soil water, wear, high and low air and soil temperatures, and soil compaction. This potential for response to integrated environmental stress effects is known as the Relative Mortality Potential. Simply stated, the Relative Mortality Potential is a comparison with other grasses of the ability of a given species to survive environmental stresses. A species with a high Relative Mortality Potential, for example, is more likely to thin out, if not completely die out, due to integrated environmental stresses than is one with a low Relative Mortality Potential. These comparative rankings for annual bluegrass and 5 other temperate zone grass species are given in Table 1. On the basis of this comparison, annual bluegrass is the species that is least likely to survive the pressure of integrated environmental stress.

Table 1. Relative Mortality Potential of Certain Temperate Zone Grasses.

HIGH	1. Annual Bluegrass
	2. Perennial Ryegrass
	3. Creeping Bentgrass
	4. Kentucky Bluegrass
	5. Creeping Red Fescue
LOW	6. Tall Fescue

The Nature of Anthracnose

Anthracnose is an important and widespread disease of maize, sorghum, wheat, oats, barley, and rye. The nature of the disease on these crops has been researched rather thoroughly. The pathogen has been identified as the fungus *Colletotrichum graminicola*, and the means by which it parasitizes these particular plant species and the factors that contribute to the outbreaks of epidemics are fairly well defined.

The nature of anthracnose on turfgrasses, on the other hand, is not well understood. To date, the pathogenic potential of *Colletotrichum graminicola* on turfgrasses has only been subjected to one comprehensive study. In the report of the results of this research, the author stated that while several varieties of seedling bentgrass were susceptible to infection by *Colletotrichum graminicola*, mature grasses, inoculated in a variety of ways, never developed symptoms of the disease. Furthermore, she pointed out that while ". . . the fungus has been conspicuous in dead or injured turf, which harbored other fungi known to be pathogenic . . . the author has never found a clear-cut case of turf disease that could be attributed to *C. graminicolum* alone." As a result of this research, she concluded that "*Colletotrichum graminicolum* is a saprophyte, growing in soil and on dead and diseased grass tissues. It is not pathogenic on mature turf" (10).

The research described above was limited to testing the pathogenic potential of *Colletotrichum graminicola* on bentgrass, Kentucky bluegrass, and tall fescue. It did not include annual bluegrass. To date, no research has been reported in which inoculation experiments were carried out to test whether or not this particular fungus can actually infect annual bluegrass. All reports purporting

Continues on page 54

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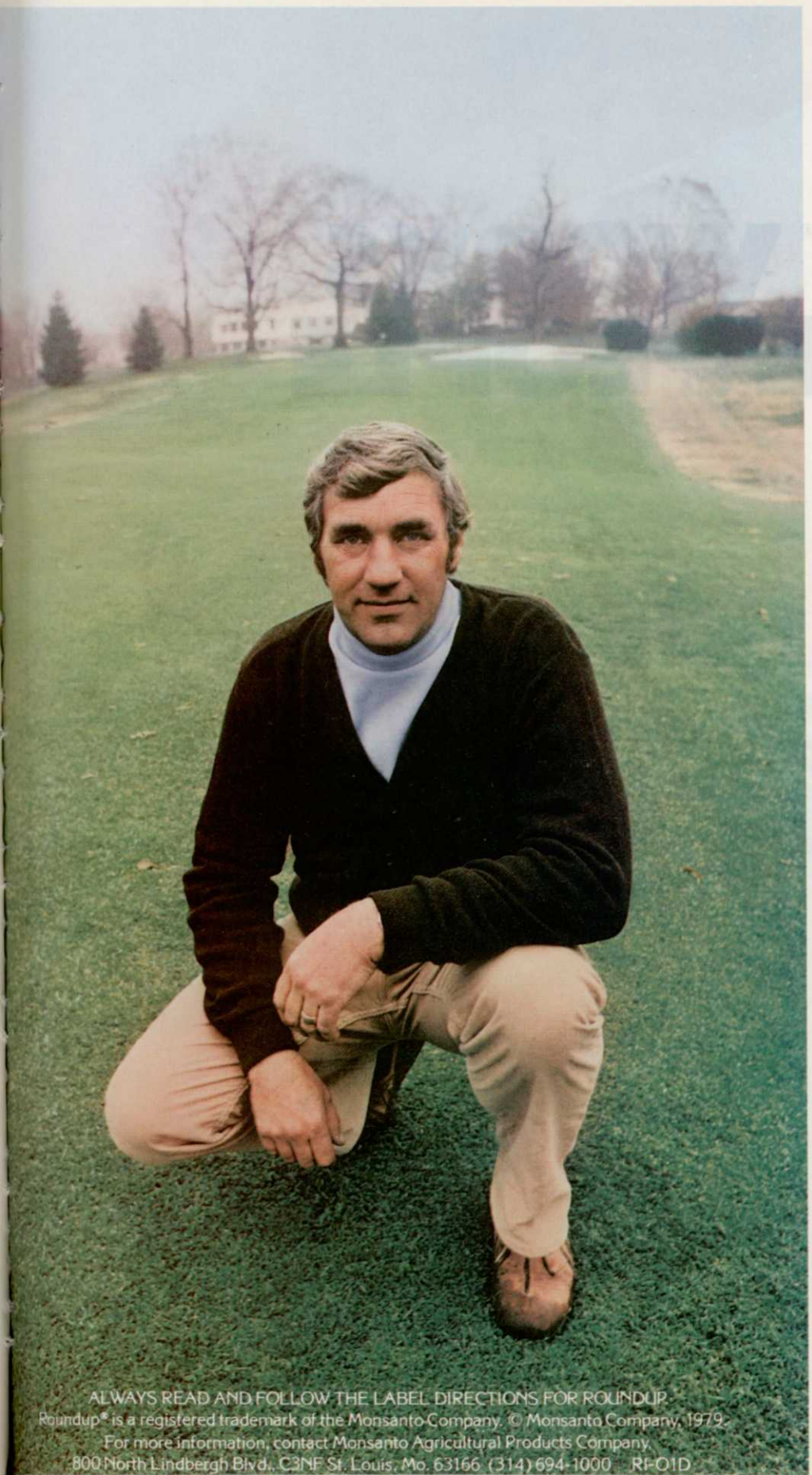

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Poa Annua

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pathogenicity have been based on observations from the field of the association of Colletotrichum graminicola with dead and dying annual bluegrass. In other words, the pathogenicity of *Colletotrichum graminicola* on annual bluegrass has yet to be shown by the widely accepted laboratory procedure of isolation of the fungus, inoculation of plants,, observation of symptoms, and then re-isolation of the fungus. All of what we feel that we know about anthracnose on turfgrass in general, and on annual bluegrass in particular, then, has been gained through apocryphal statements, field observations, and interpolations from research conducted on the disease as it occurs in cereal crops. Furthermore, a systematic field study has never been conducted to determine the exact distribution of *Colletotrichum graminicola* within the annual bluegrass growing region of the North American continent. This means that not only are we lacking in substantive knowledge of the pathogenicity of anthracnose and its potential for killing out stands of annual bluegrass, but, also, we do not know whether the fungus *Colletotrichum graminicola* actually exists in a high percentage of the areas in which the summer dying-out of annual bluegrass occurs.

> Annual bluegrass is least likely to survive the pressure of intergrated environmental stress

Is it Anthracnose or is it Wilt?

We now come to the bottom line. The question is, when annual bluegrass dies during warm, humid weather, is the cause of this death anthracnose, wilt, or a number of interacting factors? Furthermore, if these stress factors are lethal, are they necessarily the same from one area to the next, or from one warm season the next?

The lethal effects of high temperatures on annual bluegrass are well documented. When compared with the more commonly

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grown temperate zone grasses, its heat hardiness ranks among the poorest. Depending on the range and duration of the day-night air temperature patterns, the progress of the deterioration of the plant may be either rapid or slow. In the final analysis, however, the fact remains that even with the more heat tolerant strains, heat stress alone is capable of either killing annual bluegrass outright or significantly reducing its capacity to compete successfully for the same growing space with the other temperate zone grasses. Furthermore, while it is more tolerant than certain other temperate zone grasses to some of the other environmental stresses, when compared to them with respect to its capacity to survive the collective and continuing pressures of these various stresses, annual bluegrass has the poorest potential for survival.

Our working knowledge of the nature of anthracnose on annual bluegrass, on the other hand, is very limited. In addition to the lack of information on its pathology, we do not know whether the disease actually occurs in all of the areas of the North American continent characterized by the summer dying-out of annual bluegrass. If this were actually to be the case, it would indeed be a very unique circumstance, for it would be the only disease of turfgrasses that is of major importance uniformly throughout this total area.

The capacity of annual bluegrass to withstand periods of drought is less than any of the other temperate zone grasses.

Also, it would be the only turfgrass disease that is both epidemic and severe in its outbreak each year. The likelihood of this being the case for anthracnose is extremely remote.

Based on what we know about both the nature of annual bluegrass and the various disease and environmental stress factors that attend its growth, it is both simplistic and

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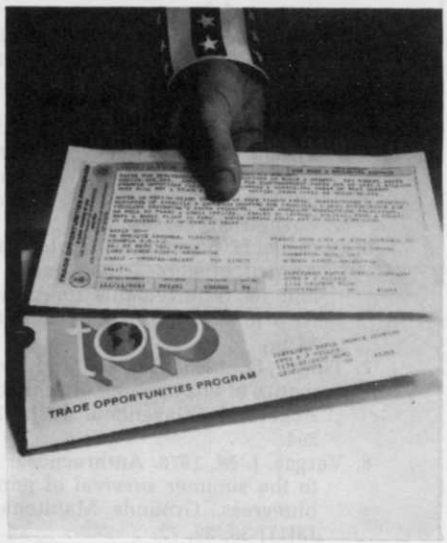

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highly unrealistic to try to designate any one of these as the universal and continuing cause of its death during warm weather. However, as we look to these various factors, certain of them can be ranked as more significant in their impact on the longevity of annual bluegrass than others. In reviewing the research information we now have, there is not sufficient data to establish anthracnose as a major factor, contributing in its own right either the widespread or local dying-out of stands of annual bluegrass. On the other hand, with the knowledge we have of the relative susceptibility of annual bluegrass to heat stress, it would seem reasonable to assume that of all the stress factors, on a a year-to-year basis, high temperature is probably the most frequent, if not the most important, single cause of the death of annual bluegrass during the summer season.

Not only are we lacking in substantive knowledge of the pathogenicity of anthrachose to annual bluegrass, we do not know if it exists in significant numbers in areas where dying-out occurs.

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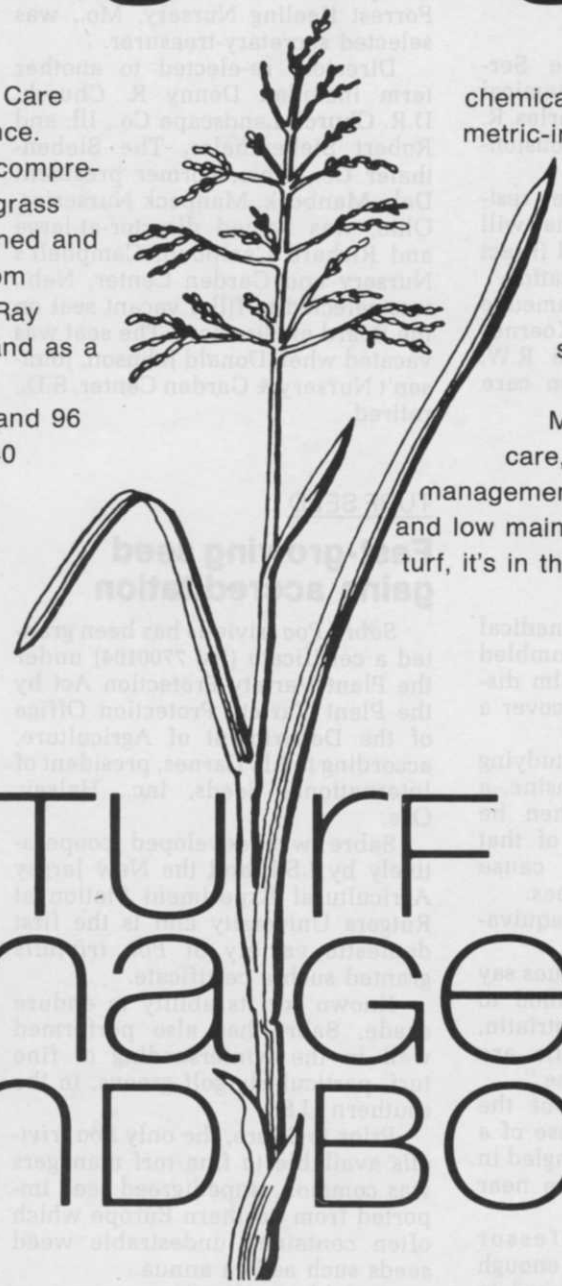

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Company announces lawn care division

Environmental Landscape Services, Inc. has formed a chemical lawn care division, said Charles R. Racusin, president of the Houston-based firm.

The new division will offer residential lawn care services that will include fertilizing, weed and insect control, and fungicide application.

Gary Koerner, has been named to head up the new division. Koerner previously worked with the R.W. Collins Co., the largest lawn care company in Florida.

TREES

Cure for Dutch elm found by accident

A University of Chicago medical student says he might have stumbled across a solution to Dutch elm disease while attempting to discover a cure for cancer.

William J. Elliott was studying ways of synthesizing maytansine, a potent anticancer drug, when he learned a chemical analog of that drug attracts beetles that cause Dutch elm disease in elm trees.

An analog is a man-made equivalent of a natural chemical.

Mr. Elliott and his colleagues say they have developed a method to produce the analog, multistriatin, and that the raw materials are "cheaper to buy than gasoline."

Mr. Elliott says a vial of the chemical is placed at the base of a tree and the beetles get entangled in fly paper when they venture near the attractive chemical.

Josef Fried, the professor directing the research, says enough multistriatin has been produced to attract all the elm tree beetles in North America.

MANAGEMENT

New officers to serve Natl. Landscape Assoc.

The National Landscape Association recently elected officers to serve the organization through 1980. Frank N. Tomlinson, Tomlinson's Select Nurseries, Calif., was elected president; Gerald Harrell, Landscapes Unlimited, Texas, was named vice-president; and Joe Wayman, Forrest Keeling Nursery, Mo., was selected secretary-treasurer.

Directors re-elected to another term included Denny R. Church, D.R. Church Landscape Co., Ill. and Robert Siebenthaler, The Siebenthaler Co., Ohio. Former president Dale Manbeck, Manbeck Nurseries, Ohio, was named director-at-large and Richard Campbell, Campbell's Nursery and Garden Center, Neb., was selected to fill a vacant seat on the Board of Directors. The seat was vacated when Donald Johnson, Johnson't Nursery & Garden Center, S.D., retired.

TURF SEED

Fast-growing seed gains accreditation

Sabre Poa trivialis has been granted a certificate (PV 7700104) under the Plant Variety Protection Act by the Plant Variety Protection Office of the Department of Agriculture, according to J.L. Carnes, president of International Seeds, Inc., Halsey, Ore.

Sabre was developed cooperatively by I.S.I. and the New Jersey Agricultural Experiment Station at Rutgers University and is the first domestic variety of *Poa trivialis* granted such a certificate.

Known for its ability to endure shade, Sabre has also performed well in the winterseeding of fine turf, particularly golf greens, in the southern U.S.

Prior to Sabre, the only *Poa trivialis* available to fine turf managers was common, unpedigreed seed imported from northern Europe which often contained undesirable weed seeds such as Poa annua.

A rigid certification program in Oregon produces Sabre seed of exceptionally high quality.

A rapid germinating variety, Sabre mixes well with the various fine-bladed ryegrasses, fine fescue, and bluegrass.

CHEMICALS

Granular linuron helps control Poa annua

The *Poa annua* problem in Kentucky bluegrass sod fields and golf courses of the northern U.S. may have met its match from granular linuron, according to a recent speech by Paul L. Jacquemin, of O.M. Scott & Sons.

In a presentation to the Kentucky, Ohio, and Iowa Turfgrass Conferences, Jacquemin announced the results of an eight-year, 20-state test program to control *Poa annual*. The tests involved the wide range of soil composition, seasonal temperature effects, application timing, and alternative before-and-after maintenance practices such as fertilizing and watering.

Jacquemin's address includes a description of the *Poa annua* problem, tests performed, a summary of the results, and detailed guidelines for use of granular linuron.

The full text of his speech, titled "A New Concept for *Poa annua* Control in Bluegrass Turf", is available by writing to Bill Boyd, O.M. Scott & Sons, Marysville, Ohio 43040.

SOD

Blue grama grass cultivated from sod

A USDA range scientist has found that sodding with blue grama grass can help areas that need erosion control and lands disturbed by mining or construction.

William McGinnies of the Science and Education Administration-Agricultural Research in Fort Collins, Colo., studied blue grama for its use on the Central Plains. A native grass, blue grama is highly palatable and nutritious but difficult to establish from seed.

Successful sodding of blue grama requires that soil be moist or wet when it is removed; it be done during periods of active growth (May and June); and sod be irrigated in its new location. Establishing the grass depends on development of new adventitious roots which come from new tillers.

Irrigating transplanted sod three times with one inch or less of water resulted in twice as many new roots as sod irrigated only once. Three irrigations also increased rate of root growth.

On the greens, the fairways...all around the links, inside the clubhouse and under all the sinks

DURSBAN 2E is the one insecticide that works. DURSBAN* 2E Insecticide is ideal for broad spectrum, multi-purpose insect control everywhere around the club. Outside, DURSBAN 2E gives you unsurpassed control of turf pests like chinch bugs, sod webworms and cutworms, plus ticks, chiggers and mosquitoes. It even wipes out bagworms and many other ornamental plant pests. Inside, it cleans up the toughest roach problems, and keeps working to rid your buildings and restaurant areas of insect pests. Ask your supplier about the one insecticide that really works, DURSBAN 2E. Just be sure to follow all the directions and precautions on the label. Agricultural Products Department, Midland, Michigan 48640.

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NURSERY

Ohio nurserymen award research grant

The Ohio Nurserymen's Assoc. (ONA) recently presented a $5,500 research grant to Drs. Charles Gilliam, Thomas Fretz, and Elton Smith of the Department of Horticulture at Ohio State Univ. for research into the container production of Taxus.

During the past several years there has been increased interest in container production of Taxus. This shift in the production techniques of Taxus is occurring without adequate research. This project will initiate a five-year study to identify the cultural characteristics necessary to successfully produce container-grown Taxus.

The potential advantages of Taxus production in containers are many and include: (1) a reduction in time of production, (2) increased uniformity of the finished product, (3) a reduction in winter desiccation, (4) reduced labor costs of digging and marketing, (5) a greater ease of managing cultural practices such as irrigation, fertilization, pruning, and pest control.

A number of problems are already associated with the practice of growing Taxus in containers: toxicities and deficiencies of minor elements, macro-nutrient deficiencies, light requirement needs, and poor root growth.

Objectives of this five-year project are:

(1) An investigation into the relationship between rates of nitrogen fertilizer, shading, and media on growth of Taxus.

(2) Establishment of deficiency and toxicity ranges of boron, copper, iron, manganese, and zinc as an aid in leaf analysis programs.

(3) An investigation of various means of accelerating growth of Taxus liners in containers immediately after propagation.

(4) An investigation of specific periods of nutrient uptake in Taxus and to determine if fertilizer applications can be timed for more effective utilization.

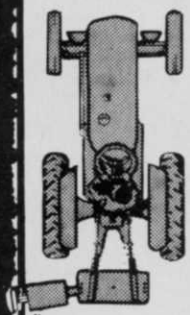
(5) A comparison of container- and field-grown Taxus for adaptability and survival rates in the landscape.

The $5,500 grant marks the first substantial commitment to nursery industry research made by the 500 member Ohio Nurserymen's Assoc. It is the hope of the ONA that annual grants of similar amounts can be made to deserving research projects.

The ONA will share all research findings with the national nursery industry as results become available.

Continues on page 65

Handy as the pocket on your shirt . . . K - D Kurb Dresser



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nance manuals. For more information on the seminars contact Rain Bird, 7045 N. Grand Ave., Glendors, CA 91740.

Weathermatic Div. of Telsco Industries has developed an irrigation malfunction report to help identify specific problems with an irrigation

Product Malfunction Report

I. Type of product malfunctioning:
☐ Control Cat. No. _____ Serial No. _____
☐ Rotary Sprinkler Cat. No. _____ Nozzle(s) _____
☐ Electric Valve Cat. No. _____ Size _____
☐ Pop-up Spray Head Cat. No. _____ Nozzle _____
☐ Shrub Head Cat. No. _____
☐ Other (describe) _____ Cat. No. _____

II. Description of malfunction, in detail:
_____
_____
_____
_____
_____

III. Answer the following only if control problem:
A. Is clock programmed properly? Yes____ No____
Pin Position? In____ Middle____ Out____
B. Is calendar programmed properly?
Yes____ No____
Pin Position? In____ Middle____ Out____
C. Power switch "On"? Yes____ No____
D. Rain-Stat? Yes____ No____. Rain-Stat cup checked? Yes____ No____.
Rain-State bypass attempted? Yes____ No____
E. Mode switch in: Auto____ Manual____
Dry Index____
F. Power switch: Off____ On____
G. 120VAC to control tested? Yes____ No____
H. 24VAC tested at valve terminals?
Yes____ No____
I. Is a pump wired to control? Yes____ No____
J. If "Yes" to pump, is wiring done according to Weather-matic specifications? Yes____ No____
K. Will controller operate valves in manual mode?
Yes____ No____
L. Tested circuit breaker? Yes____ No____

IV. Answer only if electric valve problem:
A. Flow adjustment stem? Yes____ No____
Open? Yes____ No____
B. Mainline pressure (static) _____. Actual Test?
Yes____ No____. If not actual test, how determined?
_____
C. Estimated flow in GPM? _____
D. Was pgwe4@5o solenoid leads tested?
With meter? Yes ____ No ____. If "Yes," meter reading _____ VAC
E. Are diaphragm and solenoid ports clear?
Yes____ No____
F. Was valve seat checked for obstructions?
Yes____ No____
G. Are all valves on the same control?
Yes____ No____. Has controller valve output been tested? Yes____ No____. Reading _____
H. Approximate distance from valves to control? _____ Feet.
I. Type and size of valve wiring?
_____

V. Answer only if rotary head problem:
A. Pressure at head? _____ psi. How tested (Pitot tube, pressure guage, other) _____
B. Are sprinklers flush with ground? Yes____
No____. If "No," Above____ or Below____
C. Are heads vertically plumb? Yes____ No____
D. Was an internal assembly removed to check for obstructions?
Yes____ No____. Result of inspection:
Flow tube? _____ Nozzles? _____
E. Was a gravel sump at base of sprinkler provided (when applicable)? Yes____ No____
F. Do sprinklers show damage from mowers or other maintenance equipment? Yes____ No____
G. Does nozzle drive mechanism (impact arm or gear drive) function properly? Yes____ No____
H. If "No" to above, what did investigation show?
_____
_____
I. Is problem with — Full circle? ____
Part circle? ____ Both? ____

VI. General (A):
A. Water source? City Main ____ Well ____ Lake or Pond ____ Other (specify) _____
B. Type or condition of water? Potable ____
Effluent ____ Brackish ____ Sand or Dirt ____
Other (specify) _____
C. If cause of malfunction was determined, give a brief description of what you found:
_____
_____
_____
_____
D. How many of product on this project? _____
How many are malfunctioning? _____
E. Were repairs made? Yes ____ No____

VII. General (B):
A. Job Name: _____
B. Location: City _____ State _____
C. Installer: _____
D. Distributor: _____
E. Date of Installation: _____
Owner: _____
F. System Designer: _____
G. Type of Installation: _____
(Residence, industrial plant, football field, park, etc.)

system. Donald Cooper, Weathermatic's customer service manager, sees the prime factor in irrigation maintenance as identifying the problem. By using the form you can help the irrigation repairman locate the problem without a time-consuming and expensive search.

Weathermatic has designed plug-in timing boards for easy replacement and has instituted a rebuild/exchange program to keep repair costs down.

Cooper recommends the following service:

Controls

Before working on controls make sure that the problem is in a control. You may have a valve problem. A majority of timing problems can be remedied by replacing the timing board. This process is simplified with plug-in timing boards.

Valves

Check for proper operation of solenoids and diaphrams. Replace as needed. Also check for leaks at all times.

Sprays

Clean or replace nozzles and bodies when plugged. Adjust to ground height.

Rotaries

Clean and flush. Adjust to ground height. If the problem is not readily discernable, replace inner assemblies and return to distributor for repair or rebuild/exchange.

Cooper recommends stocking the following spare parts:

Controls — timing board, clock motor, relays
Valves — solenoids, diaphragms, exhaust fittings
Sprays — spare nozzles and bodies
Rotaries — complete inner assemblies, strainers,

Rain Bird turf product technical manager Cozz Regele cautions that heads should be the right height for the grass and should be perpendicular to grade. Regele also cautions that wire connections be checked for corrosion regularly and that water tight fittings be used. Flushing new systems will avoid headaches later with plugging. To flush properly, cap all risers except the last one on the circuit and flush. After a thorough flushing, cap all risers except the lowest one on the circuit and flush again. On larger looped systems, Regele suggests that small sections be isolated by shutting off zone valves before flushing. Regular cleaning of filter screens should prevent plugging after thorough flushing. **WTT**

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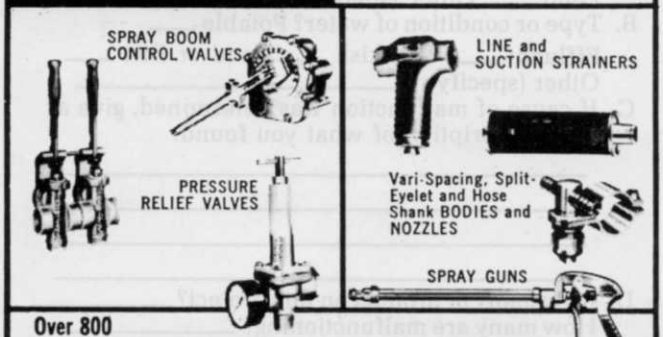

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For economy prices and more information on our complete line of tanks, write or call now:

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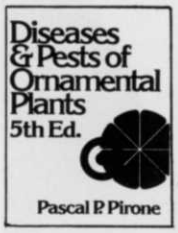

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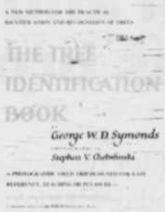

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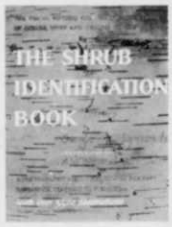

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2-4-5-T/Silvex problems?

Help has Arrived!

Trimec® is now the answer for brush and tree control as well as broadleaf weeds.

We heard your call for help.

You said that with today's budget squeeze you can no longer afford to use expensive man hours cutting brush and weeds and trees.

And you also said that in this age of environmental concern, you must be extremely selective in your choice of chemicals.

Trimec is your answer. The very same Trimec that has become the number one broadleaf herbicide in the professional turf community is now recommended for control of brush and trees, and its efficiency in this field matches its efficiency in the broadleaf weed world.

We knew as early as 1969 that Trimec was extremely effective in controlling brush and trees, but we made no attempt to register it for such use because highway superintendents seemed satisfied with a combination of 2,4-D, mowing-and-cutting machinery, and manpower... So we diverted our energies toward those who wanted to maintain immaculate turf.

But by 1975 labor costs were forcing the highway superintendent to depend more on sophisticated chemicals, which in turn attracted more attention from the environmentalists.

The chemical 2-4-5-T was being questioned; other effective herbicides were being restricted; new herbicides were too expensive; and some of the older ones were damaging farmers' crops.

And thus it was that we undertook the necessary research to get brush and tree control registration for Trimec.

Now you have an efficient, effective, economical, environmentally acceptable chemical that controls broadleaf weeds, brush and trees along highways, and encourages the growth of desirable grasses.

- **Biodegradeable.**
- **Works in temperatures as low as 50° and cooler.**
- **Snynergistic power of 2,4-D, dicamba and mecoprop puts less hazardous chemical in the environment.**
- **Trimec formulation works slowly and translocates to the root system.**
- **Wide-spectrum control of brush, trees and broadleaf weeds.**

A test proposal: Take your toughest problem—brush and tall weeds that restrict visibility at an intersection. Use Trimec on one side, any other chemical on the other side. Record the costs and the effectiveness. If Trimec doesn't win hands down, we'll be very much surprised.

If there is not a Trimec distributor near you, call us direct — toll free 1-800-255-4450. Ask for Brush Control Department.

Trimec® is a registered trademark of PBI/Gordon Corporation, U.S. patent No. 3,284,186.

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NURSERY

Roundup registered for nursery crops

Use of Roundup (glyphosate) in nursery crops has been given EPA approval, announced the Monsanto Chemical Co. Its long-awaited use has been approved for application as a preplant treatment to control weeds prior to planting all nursery crops and as a directed spray under 15 genera of woody ornamentals.

The following are some of the perennial weeds that are controlled at rates of 2-5 quarts/acre depending on species, stage of weed growth, and environmental conditions: bindweed, bluegrass, cattail, dock, fescues, Johnsongrass, milkweed, orchardgrass, quackgrass, and thistle.

Roundup will be used as a directed spray toward the base of established woody ornamental species, such as: arborvitae, azalea, boxwood, crabapple, euonymus, fir, hollies, lilac, magnolia, maple, oak, privet, pine, spruce, and yew.

Extreme care must be exercised to avoid contact of spray with foliage of desirable turfgrasses, trees, shrubs, or other desirable vegetation since severe damage or destruction may result.

EQUIPMENT

Tree transplanter may help China mechanize

Hoping for a contract for 1,000 tree transplanters, Big John Manufacturing Co., Heber Springs, AK, is shipping a 2,800 cubic foot truck and machine to China.

The company received a formal invitation from the Chinese to demonstrate the device in Peking.

Big John stockholders Sam and Jim Manatt observed tree transplanting by hand on a recent trip to China. The company has printed a brochure in Chinese for the event.

Professionals Use Bob Cats with Purr-r-fect Pride!

Available in 61" or 74" cut widths

If you are using one of our 10 Bob Cat mowers, you know what we mean by *'Purr-r-fect* Pride'. If you haven't tried a Bob Cat yet, maybe now is the time to do it. You'll find out what durability, dependability and *purr-r-fectly* mown grass really are. Let us show you why Bob Cats are becoming the biggest names in lawn care.

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Compared to chemical treatment, AQUAMARINE harvesting is:

POSITIVE — No need to wait days, or even hours to assess results. The HARVESTER reaches down, cuts and removes weeds *right now* — surely and efficiently as a combine gathers grain.

ECONOMICAL — Independent studies show that when it comes to the bottom line, you can't beat aquatic weed harvesting in the cost of work completed. Studies are available on request.

CLEAN — If water is clean enough for swimming before the HARVESTER makes its pass, it's clean enough for swimming in its wake.

LET US TELL YOU MORE — The CHUB & H-650 HARVESTER are just two of many machines and systems pioneered by AQUAMARINE for clean, safe, effective water weed control. Reliable? After twelve years continuous production, every piece of equipment is still in service. Let us help you select the right machine or design a system for you.

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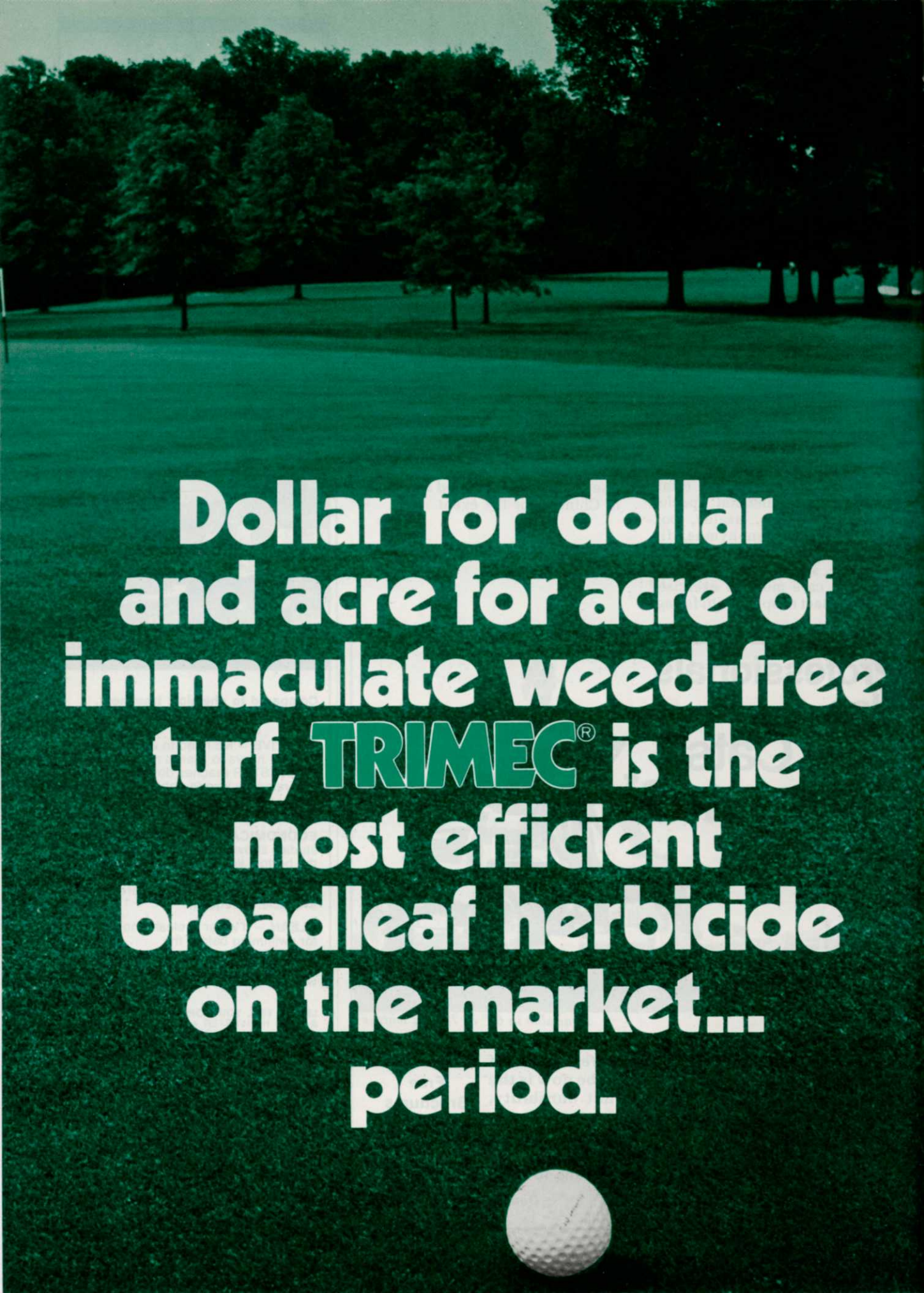
Dollar for dollar and acre for acre of immaculate weed-free turf, TRIMEC® is the most efficient broadleaf herbicide on the market... period.

Test it...prove it. Weed-free turf costs less with TRIMEC®

Learn why no other broadleaf herbicide matches Trimec for efficiency, economy:

First, let's get one thing straight. We're not talking about dandelions and chickweeds. Sure, you have to kill them. But anybody can do that.

What we're talking about is *immaculate* turf. Flawless. Beautiful. Pure. The kind you're dedicated to producing, paid to achieve. And you can. Because that's what we do best . . . *immaculate turf.*

To have it, you need just two things: the will to have it; and the broad-spectrum power of TRIMEC . . . the herbicide that wipes out practically *all* broadleaf weeds. We've identified at least 30 species that Trimec controls. If we find one it doesn't control, we'll be very much surprised!

But power isn't all. We promised efficiency. And that goes beyond mere broad-spectrum power. Efficiency entails economy, as well. And ecological merit. And conservation of your time and energy. In all of these ways, we say TRIMEC has no equal.

How can we be so confident? Because we have massive supporting evidence based on research and testing and years of field experience by turf professionals like you. The key to this impressive performance is in the Trimec patented formulation.

Why Trimec is unique

The Trimec formula, unlike any other in the world, uses ordinary components in an *extraordinary* way. We're talking about 2,4-D, MCPP and Dicamba, the familiar chemicals. But there's a marked difference in the way they're put together. The result is best explained by the word *synergism.* That is, the interaction of Trimec ingredients produces an intense yet gentle strength: weedkill power *much greater than the sum of the components separately.* This mathematical phenomenon (a kind of 2 + 2 = 5 effect) brings important benefits:

1) **Broad-spectrum power that kills practically all weeds.**
2) **A smaller chemical dosage per acre of coverage.**
3) **The consequent reduced threat to ornamentals through less root-absorption and less-concentrated "drift".**
4) **The lower cost of more efficient chemical usage.**
5) **Low-temperature efficiency: effective at 50° F. or cooler.**

Bent grass formula also available

Herbicide efficiency entails more than broad-spectrum power. It demands economy, ecological merit and conservation of your time and energy.

Unmatched efficiency

Normally, one light application controls nearly all broadleaf weeds, even hard-to-kill species. Trimec costs less per acre of immaculate turf than any other herbicide. You use fewer gallons, you seldom need retreatment, your total cost is lower.

Environmentally sound

The same qualities that make Trimec more efficient also make it more trouble-free in use. Biodegradeable, precisely factory-formulated, Trimec eliminates "field chemistry" and the chance of mixing errors that could harm soil and ornamentals.

Trimec benefits

- Controls the wides range of broadleaf weeds
- Gets hard-to-kill species with one treatment
- Wide safety margin for lawn grasses, ornamentals
- Minimum hazard from root absorption
- No vapor action after application
- Effective weed control in wide temperature range
- Unique formula overcomes water hardness problems
- Treated areas may be reseeded within two weeks
- Non-flammable and non-corrosive in use
- Product stable several years above 32° F.
- Biodegradeable, friendly to the environment

A test proposal

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VEGETATION MANAGEMENT

By Roger Funk, Ph.D., Davey Tree Expert Co., Kent, Ohio

Q: *We would like some information on Devrinol by Stauffer Chemical Company and growth retardants for ivy.*

A: Devrinol (common name, napropamide) is a selective herbicide with an acute oral LD_{50} greater than 5000 mg/kg. Devrinol, available as an emulsifiable concentrate (2-E), a wettable powder (50%) and as 10% granules, is labeled for the control of several grass and broadleaf weeds in orchards and vineyards. It is also effective for weed control in direct seeded tomatoes, strawberries, tobacco, and certain other crops. Read the label and check with your local extension agent for specific instructions in your area.

Q: *Much has been written about insecticides and chinch bug controls. What are the procedures for repairing the damaged turf areas, basically on home lawns?*

A: The simplest method of renovation would be to verticut the damaged area and seed with a compatible mixture or blend. The soil should be moist (but not wet) and verticutter adjusted to cut into the soil about ¼ inch in order to provide the proper seed bed.

Q: *I would like to know if there are any new methods to kill moles. Is chlordane still used?*

A: I do not know of any new materials or methods to control or kill moles.

Chlordane was used to eliminate grubs, a primary food source for moles, but chlordane is no longer labeled for use on turf. Diazinon, Dursban and Proxol are currently labeled for grubs, but the timing of application is more critical than with chlordane because of the shorter residuals. Also, elimination of grubs is no guarantee that the moles will go away.

Other standard methods of mole control are traps, poison baits or fumigation. The most effective method probably is the use of the harpoon or choker traps. To find actively inhabited tunnels, raised sod should be rolled or trampled down. If the tunnels are raised the next day, a trap should be set in that place. Traps which are not "tripped" should be reset in another place daily. Gases have proven ineffective since gas will diffuse out of the tunnel through the thin layer of sod overhead. Poisoned baits are generally ignored by moles.

Q: *Because of very hard water from our own well, the trees at our golf course become coated with a*

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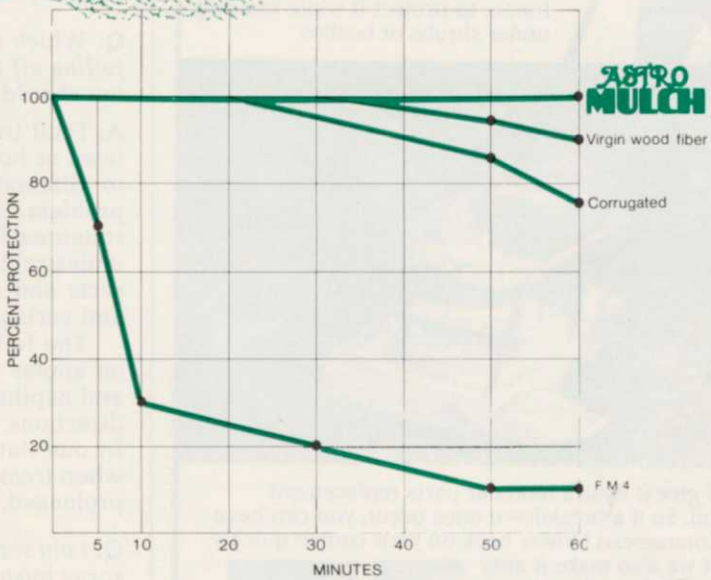

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  412 113th St., Arlington TX 76011
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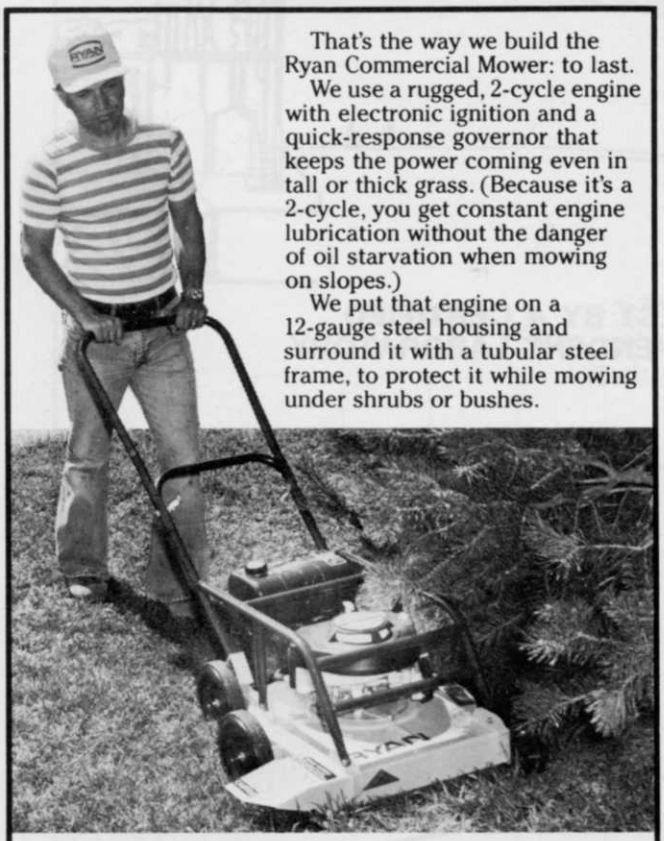
You may retire before our mower does.



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white material which covers leaves, needles and trunks. This either chokes the trees to death or weakens them to a point that they grow very little.

Is there any chemical which I can put on the trees to eliminate this hard water deposit buildup?

A: Calcium deposits are extremely common where there is hard water. When the water dries, the calcium remains on the trees and shrubs.

I have not found an economical way to treat the large volume of water required in irrigating a golf course. The U.S. Department of Agriculture is conducting studies on desalting farm and range land which may provide answers for your problem; I suggest you contact the USDA office in your area.

Another branch of the government is working on utilization of sea (salt) water for irrigation. The same procedure could be used on your water; however, it presently does not appear to be economically feasible.

Q: *Which chemical will prevent crabapples from falling off the tree? What time of year and how often should application be made?*

A: Fruit trees are sometimes planted for shade in lawn or home garden areas, but the owner wishes to eliminate the fruit which normally becomes a problem. Unsprayed fruit will become wormy and rotten each year and drop before it matures. The undesirable fruit attracts bees, flies and other insects and makes additional problems in mowing and caring for the lawn.

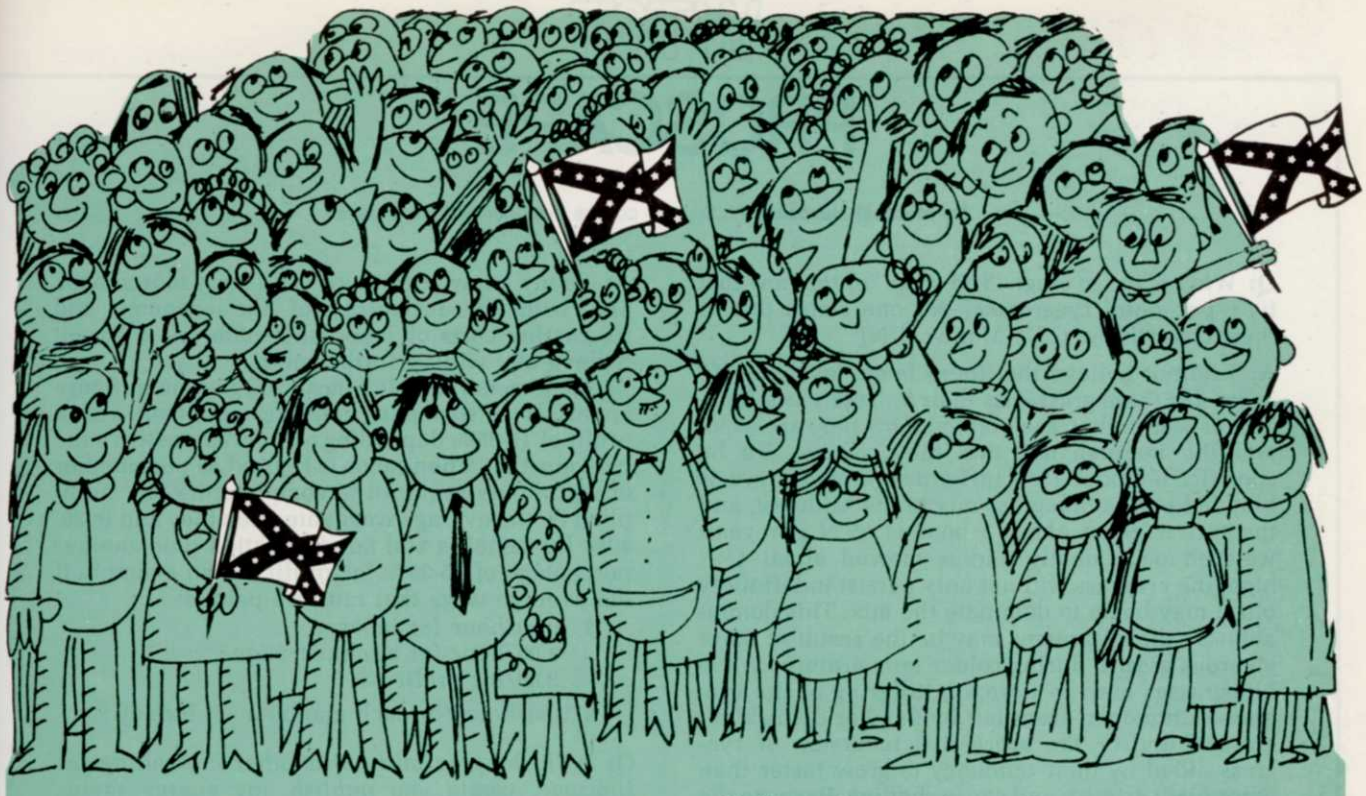
The following chemicals are suggested for trial on apples and crabapples: napthalene acetic acid and napthalene acetamide. Apply according to the directions. Rates of 15-30 ppm have been suggested by one state experimental station. Apply the spray when trees are in full bloom; if the bloom period is prolonged, make a second application in 3-4 days.

Q: *I am seriously considering starting my own lawn spray business. I have some experience in the field but need to get some answers, such as licensing required in Michigan. Also, any tips on starting my business would be much appreciated.*

A: Since you are in Detroit, contact Carl Dollhopf, the regional supervisor, 1120 West State Fair, Detroit, Michigan 48203, phone (313) 368-2230. Unless the procedure has changed recently, it is as follows: 1) Apply for applicator certification tests, accompanied by fee; 2) Receive self-study guide; 3) Take test and, if passed, will receive certification number valid for three years; 4) Apply for company license, submitting fee, and for applicator's certification number. You must also submit proof of bonding (annual renewal).

Q: *I would like to know about any products that inhibit growth on broadleaf evergreens such as privet, photinia and English laurel, used for hedges.*

A: There are two plant growth retardants which have been commercially available for a number of years; both are labeled for a limited number of trees and shrubs. The products are maleic hydrazide, sold by Uniroyal, Inc., under the trade name Slo-Gro; and chlorflurenol, sold by U.S. Borax and Chemical Corporation, under the trade name Maintain CF-125.



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"Dixie Green® has given me a uniform, dense putting surface that has putted consistently true. The color has been outstanding . . . even though the temperature in January dropped to 11 degrees F. Bent greens went off color . . . but Dixie Green® came through like a champ." Ed O'Donnell, Superintendent Brook Valley Golf & Country Club, Greenville, North Carolina.

Dixie Green® overseeding mixture is a premier mix of Highlight Chewings-type red fescue which was judged World Champion at the 45th Annual Royal Agricultural Show in Toronto, and Derby turf-type perennial ryegrass. This fine mix has proven a winner for winterseeding of greens, tees and aprons all over the South. Dixie Green®—a great mixture for you and your members.

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PROSCAPE

By Michael Hurdzan, Ph.D., golf course designer and consultant

Q: *What is the average "life span" of the new turf type perennial ryegrasses? No one states this in their advertising. G.E., Mahwah, NJ*

A: I do not believe that there is an "average life span" for these grasses as their longevity is a function of where they are planted, how they are used, and the maintenance that they receive. To be specific, if about 15% turf-type perennial rye is blended with a bluegrass mix in the Midwest, and the turf is given about 3 pounds of N per year, watered occasionally and is mowed about 1½" high, the ryegrass will not only persist indefinitely but it may begin to dominate the mix. This domination by the ryegrasses may be the result of more vigorous growth during colder temperatures when bluegrasses may be dormant, tillering of the ryegrasses into open areas left by dead or dying bluegrasses, and/or the aggressive incursion of ryegrass aided by their tendency to grow faster than other turf varieties and cause shading. Because the ryegrasses are so competitive, it is usually recommended that not more than 20% of mix be turf-type ryegrass and some believe that it should be only 5% of the seed mix.

Q: *I have read Proscape for the past one and a half years and I have wondered what value is a Consultant. It seems more often than not whenever a Consultant is called in someone loses their job. Doesn't this bother you or how do you avoid the situation? J.P., Minneapolis, MN*

A: First, a Consultant is rarely ever called unless there is a problem that the resident staff has not been able to solve with in-house skills and information. So, when a Consultant is called it is with the hope that he will provide that information or skill that will correct the problem.

Many times the problem is so acute there is no easy solution and nothing can be done but start over. When this happens the Consultant's worth may be questioned for we all want easy solutions. However, it is the professional responsibility of the Consultant to be as candid as possible with all parties involved about situations that he is 100% confident about. If he is uncertain about a particular problem then he should say so and make sure any remarks are taken as only speculation.

It indeed bothers everyone if a man loses his position over a Consultant's report; but most often the report is simply used as an excuse to terminate an employee and is not the real reason.

Q: *Are there any industry averages breaking out income and expenses within the landscape design and landscape contracting business? Robert Morris Associates publishes a composite statement for horticultural services which lumps the two together and is not very specific with regard to income percentages.*

A: To my knowledge there is no such source book and with the instability of the economy and fluctuating costs of labor and materials I do not believe any will be forthcoming.

As a general rule, most practitioners figure materials at cost plus handling and then add a profit of 15-35% depending on how competitive the bids must be. Then labor is figured as per number of man hours required to complete the job multiplied by the average wage rate, then they add in 25-30% for benefits and administration plus another percentage of 15-20% for profit. As an example if the average wage that must be paid is:

$ 10.00/hour for laborer
3.00/hour for administration
2.00/for profit
$15.00/hour for each manhour on the job

Q: *With the possibility of another impending gas shortage, would you publish any energy saving ideas that may have been shared with your magazine when we had the Arab oil embargo of a few years ago? Or ask your readers to submit any suggestions they may have used. Y.C., Westminster, CO*

A: An excellent suggestion. *Weeds Trees and Turf* would be pleased to print and credit any ideas that would help conserve our limited energy resources.

Q: *What is the best and most inexpensive method to break up clay soil (hard) over which sod has been placed? After five years we are still having difficulty getting the grass roots to penetrate this clay. Northern Virginia, VA*

A: I would suggest that you review the Proscape column from the February 1979 issue of WTT. The described procedures are about as inexpensive as possible and yet achieve some notable results.

Q: *What is the best and cheapest ryegrass that will grow in Clay without watering and the least mowings? AA Inc., Angola, NY*

A: I assume you mean turf-type ryegrass. All ryegrasses seem to perform well in clay that has been properly prepared for seeding. Of course, the terms best and cheapest contradict. Much research is taking place lately comparing ryegrasses with the result of newer improved varieties. Cheapest ryegrass is the older Linn in most cases. Manhattan will be near the top of the cost list. Derby is a moderately priced improved ryegrass. There are many others of good quality you should consider.

Although height is one growth characteristic improved lately with lower growing cultivars, growth regulators can reduce the number of mowings in low wear areas where vigorous growth is not needed to fill in damaged spots.

You'll pay more for lower growing, clean cutting, and deeper green types of ryegrass. But you may save in other ways.

IRRIGATION

IA and IDIA reach consolidation accord

The Presidents of The Irrigation Association (IA) and the International Drip Irrigation Association (IDIA) have announced to their memberships an agreement reached between them which will result in the consolidation of their efforts for the betterment of the entire irrigation industry.

Taylor Ramsey of The IA and John Riddering of the IDIA said in a joint letter to their members that "... we have agreed to associate together in the future for the benefit of all of us." As a result of the agreement, the two Presidents are "jointly recommending and calling for the immediate joining of The Irrigation Association by all members of the drip/trickle industry."

Discussions between the two organizations on a coordination of their efforts have been conducted over the last two years and culminated recently in a contract signed by their respective officers. The contract details arrangements whereby the outstanding debts and obligations of the IDIA will be paid through a rebating to the IDIA of certain funds over the coming months. The contract also looks to the reestablishment of the drip/trickle scholarship fund and details consignment of IDIA publications to The IA for sales to the industry.

In addition to the basic contract between the IDIA and The IA, a letter has been received by the IDIA from President Ramsey outlining the policies and procedures The IA will follow in the organization and operation of The IA's new Drip/Trickle Division. The IDIA Board of Directors has unanimously endorsed the agreement and its individual members are taking immediate steps to become members of The IA, an action which they hope will encourage other members of the drip/trickle industry to do also.

All members of the drip/trickle industry have received membership applications for The IA along with the joint letter. They are being urged to join the IA at this time and to participate in The Irrigation Technical Conference in San Francisco on February 18-21.

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WT&T PRODUCTS

The "Claw," from Wastequip, Inc., is used to pick up tree prunings, leaves, grass, and other yard and garden refuse normally placed along gutter lines of municipal streets. The machine works equally as well with wet and dry materials.

The "Claw" attaches to most conventional wheel front loaders of ⅞-cubic yard capacity or more. When fully open the unit features an overall width of more than 90 inches and a length of 61 inches. When fully closed the overall width is 71 inches. In addition, it has a height of 28 inches and weighs 900 pounds.

Two men are needed to run the machine. One man to drive the loader and attached "Claw" and the other to drive the truck.

Thus far field tests in several California cities has shown that the "Claw" in a two-man, two vehicle operation can harvest as much as 25 tons of yard and garden refuse daily, according to the manufacturer.

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Lawn Pro Spraying Systems introduces a 500-gallon sprayer which provides the versatility of boom application. The unit features a 25-foot, spring-loaded breakaway boom for spraying commercial and industrial lots, athletic fields, and other areas.

Additional equipment includes a 500-gallon, baffled, stainless steel tank, in-cab controls to operate the pump and the hydraulic boom, a chemical inductor for ground-level filling, and a 300-degree rotating Hannay electric rewind hose reel.

The sprayer also features the patented "venturi suck-back" system which immediately stops the solution from flowing when the boom is turned off.

Circle No. 702 on free information card

Progressive Electronics, Inc. introduces "Pulser," a buried cable fault locator for use by zone irrigators.

The operator, using variable-distance earth probes, follows the faulted line with the "Pulser" meter until the fault is located. The unit emits a 3,000 volt pulse every three seconds.

"Pulser" is portable and comes in a vinyl-covered case approximately 20 inches wide by 8 inches deep by 5 inches high. It also features a rechargeable battery, built-in battery check, and an audio output unit.

Circle No. 703 on free information card

Futura turf grass mixture, a precision blend of three turf-type perennial ryegrasses (Blazer, Fiesta, and Pennfine), is available for commercial sale from Pickseed West, Inc.

Pennfine is a well-known cultivar and Fiesta and Blazer are two of the newest turf-type perennial rye-

Circle 150 on free information card

grasses developed by Dr. Reed Funk of Rutgers University.

The varieties were selected for their outstanding turf qualities including dark green color, disease resistance, mowability, fine texture, and overall turf density.

Circle No. 704 on free information card

AFMC Sidewinder offers the SC-60 rearmounted utility mower. The mower features a 35-horsepower rated gearbox, front roller, and adjustable side skids to prevent scalping.

The SC-60 also features three updraft blades with an inch-and-a-half overlap which provides an even, controlled cut. The mower blades are enclosed.

Circle No. 705 on free information card

A medium size grader, made specifically for close quarter situations where larger machines are inefficient, is available from Vermeer Manufacturing Co.

The G-960 grader features an articulated frame which puts all wheels on the graded surface, provides a 4½-foot cutting radius, and allows the rear wheels to track the same path as the front wheels.

The four-wheel drive grader is powered by a 28-horsepower, air cooled, Deutz diesel engine with hydrostatic drive and all-hydraulic control. It is also equipped with a six foot, front-end dozer blade which cuts to a maximum of four inches below and 12 inches above grade. The eight foot center blade cuts three inches below and ten inches above grade.

Circle No. 706 on free information card

Row Crop Sprayer, a self-propelled, three-man spot spray vehicle, is offered by the Hustler Corp. The vehicle features adjustable wheel and seat widths, an electric start, ten-horsepower engine, and a transmission system with forward and reverse gears.

Spray material is applied through three individual handguns which are operated by an electric pump and fed by a 55-gallon polyethylene tank. Material can also be applied through a wick bar applicator which is electrically actuated to raise and lower the bar.

Further, the wheels can be adjusted to allow the vehicle to be transported in a standard pickup truck. The sprayer weighs about 600 pounds.

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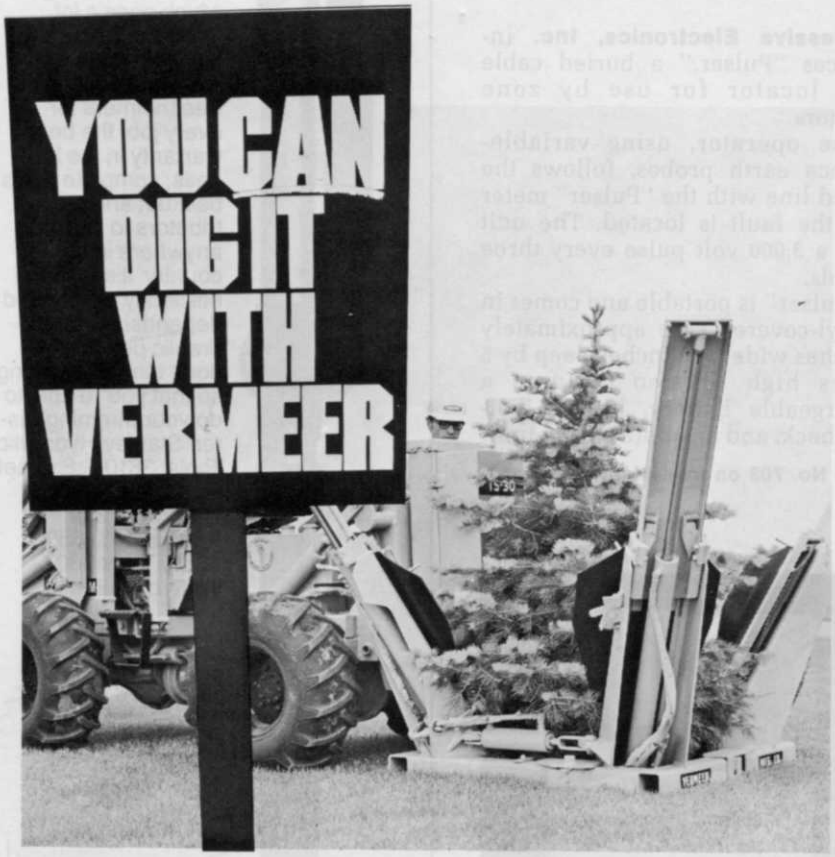

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Some Folks Like Their Citation Mixed While Others Prefer it Straight.

Citation is mighty popular around these parts, but there's no need for a shoot-out. Fact is, Citation has a great reputation for fast germination, outstanding heat tolerance, disease resistance, and packs a dark green color. Try it on an area you want to dress up and we think you'll check in your guns and notice an improvement in your disposition.

CITATION

There may be a little room for argument here. CBS is a mixture of Citation, Birdie and Omega fine leafed perennial ryegrasses, blended especially for overseeding for use as winter turf in the south. Each variety used in the blend has a different genetic background to improve overall performance. CBS blend is mighty fast too, so the whole shootin' match could be a stand-off.

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National Diversified Sales, Inc. offers a complete line of more than 60 different configurations of plastic drain fittings, ranging in size from three inches to eight inches.

The company recently developed three inch and four inch ABS adapters for sewer- and drain-size pipes. Also recently available are three inch and four inch styrene drop-in drain grates.

Plastic fittings are lightweight, corrosion-resistant, rustproof, and durable according to the manufacturer.

Circle No. 708 on free information card

Pasquali U.S.A., Inc. introduces an entire line of walking, steering, and traditional tractors.

The Model 988 tractor features a number of attachments including single furrow plow, cultivator, embanker, sod-breaker, baler, and three furrow plow. In all, 79 attachments are available, along with more than 45 additional accessories.

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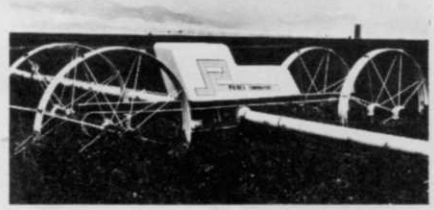

Pierce Corp. has developed an automatic wheel roll sprinkler irrigation system which utilizes microcomputer technology to automatically irrigate sod fields.

Incorporated into the system's control panel is a micro-processor which enables the turf grower to program the watering cycle and drain times required for each individual field.

The "Auto Side Wheel Roll" is made for use with five inch tube on 58 inch, 64½ inch, or 76 inch wheels for quarter mile systems. The unit's dual mover design insures continual alignment as the wheel moves down the field. The system is powered by an eight-horsepower engine featuring a power start-up unit and automatic battery charger.

Circle No. 710 on free information card

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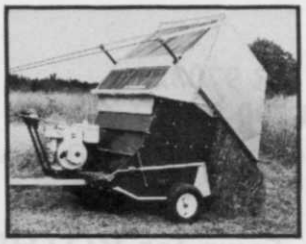

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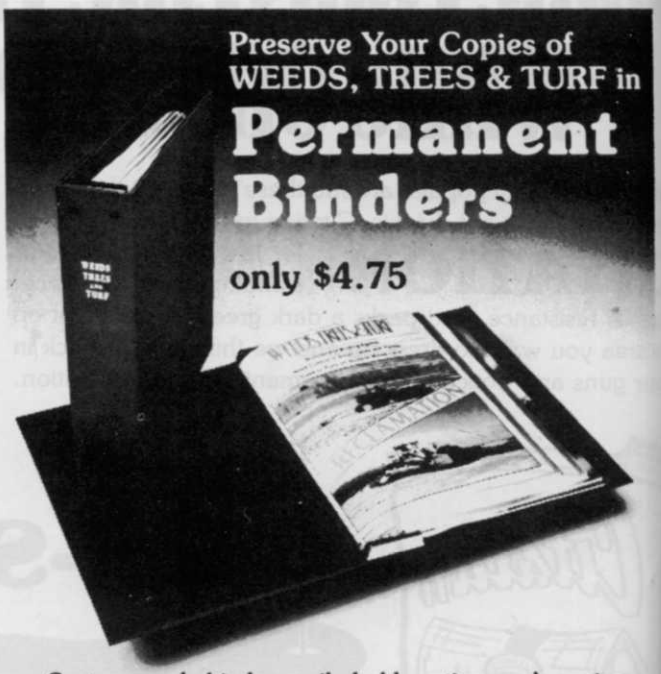

Custom-made binder easily holds entire year's copies of WTT magazine. Green binder with gold embossed logo protects your magazines and gives your library a neat appearance. Magazines can be inserted as they are received. Annual index in December issue makes it easy to find information you need quickly . . . Send check or money order to:

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GET FUNGUS OFF YOUR MIND.

GET MEAN ABOUT GREEN WITH A JUST-RIGHT CONTROL FROM MALLINCKRODT.

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other small engine housings while in the field.

The melting point of Uni-Al is about 400°F, lower than the melting point of aluminum. Both blow torches and propane, butane, and Prestolite torches can be used to melt the brazing rod. No flux is required.

Circle No. 711 on free information card

Hydra-Mac, Inc. has added the Model 9C Series III to its line of skid steer loaders. The loader features a 30-horsepower Isuzu diesel engine and a heavy duty cooling system.

Other standard equipment includes an all gear drive system, dual hydra-lever controls, a 24-month gear drive system warranty, and an "easy tach" system for quick attachment changes.

Among the options are a third hydraulic control valve, sweeper, trencher, rotary mower, and full horsepower live mechanical power take off.

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THE CUTTING EDGE

MOTT® mowers cut everything from fine lawns to high weeds. Even in the rain, MOTT mowers keep going where rotaries bog down. The free-swinging, self-cleaning flail knives deposit the mulched cuttings in an evenly distributed layer for faster, natural disintegration. The absence of windrows means not only a better appearance but also the ability to recut without problems. For the cutting edge in turf maintenance specify MOTT.

Cutting Widths From 38" - 88" And Gangs To 19 Feet.

"Tell me more about FLAIL SAFE mowing."

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MOTT CORPORATION

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The Swinger Model 200 front loading tractor features a Continental 162-cubic-inch, gas engine as standard equipment. The four-cylinder, water-cooled engine produces 48.3 SAE horsepower.

Other features include a replaceable dry-element filter, full flow cartridge oil filter, a 16.5-gallon fuel tank and a sealed 30 amp alternator. In addition, the Model 200 can be towed from site to site, eliminating the need for a trailer.

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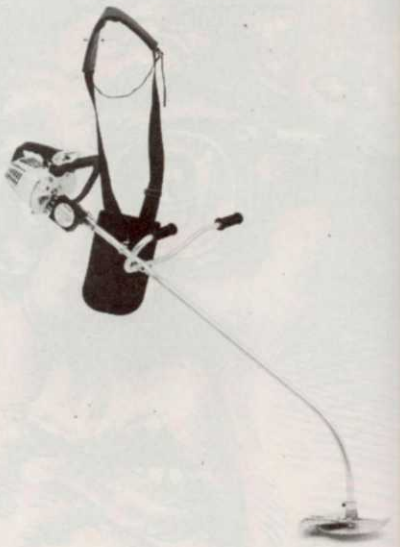

Hoffco, Inc. offers a chain saw attachment which converts more than 40 popular-selling saws into brush cutters, weed cutters, lawn edgers, and tree trimmers. The saw is converted by replacing its bar and sprocket with a clutch drum pulley and drive belt that transmits power through a flexible shaft to a 44-tooth brush saw blade or Hoffco's Tri-Kut weed blade. An optional monofilament trimming head may be substituted for either blade to make the tool a lawn trimmer or edger. The saw also comes with a shoulder harness and special handles which keeps the operator away from the cutting blade.

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THE GREEN MAGIC™ SYSTEM

With MICRO-MUNCH

Decomposes undesirable Mat & Thatch and prevents it from re-developing

BEFORE

At time live soil bacterial spores were applied — note the accumulation of compacted Mat & Thatch at the surface. Heavy thatch sheds water, harbors insects and disease, and prevents deep root growth.

AFTER

15 weeks later — same lawn — note that the Mat & Thatch has almost completely disappeared, roots are deeper, and the soil is looser and in better physical condition due to bacterial decomposition.

INTRODUCTORY OFFER

Now, for the first time, a complete, natural product is available that contains natural organisms along with a completely balanced diet that will:

1. Naturally decompose mat & thatch up to ¾" within 9 to 12 weeks
2. Create more ideal conditions for the natural soil organisms to grow and multiply so they can continue their decomposition of Organic Matter, and at the same time, build up the productive capacity of the soil.
3. Reduces the stress conditions that produce insects and diseases, and provides a complete, balanced diet for the natural growth of desirable turf.
4. Reduces the need for: Frequent fertilizing
   Frequent watering
   Frequent applications of pesticides (fungicides & insecticides)
5. Eliminates the need for: Power Raking
   Frequent reseeding & resodding
   Loosens, aerifys and builds more productive soil naturally, along with beautiful, healthy plants.

   All you need to do is to mix the ingredient into your power spray rig, spray uniformly over your lawn — one application this season will decompose ½" to ¾" of Mat & Thatch, when used as directed.

ONE TIME OFFER — EXPIRES JULY 30, 1979

or as soon as current supplies are exhausted

1. 10,000 sq. ft. treating kit Cost = $176.20

or

2. 110,000 sq. ft. treatment kit
   List price = $1894.75
   Less introductory Disc. = 284.21
   $1610.54

Plus 1 Free Complete Soil Analysis
Value = $250.00

Note: If you wish to continue growing your lawn naturally, healthfully and least expensively, it is essential that we test your soil to determine any problems or un-natural conditions that may kill the bacteria. The soil test comes with a complete report and recommendations.

ORDER FORM

Please rush the following:

No. of Kits	Kit Size	Price Per Kit	Total Cost
_____	10,000 sq. ft. Green Magic w/MICRO-MUNCH	$176.20	$ _____
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TOTAL KITS_____ TOTAL ORDER $_____

_____ Check for $_____ enclosed — Freight will be paid by Agro Chem, Inc.

_____ Please charge to my (check one) _____ MASTER CHARGE, _____ VISA
(Freight prepaid by Agro Chem, Inc.)

_____ Please bill my company, P.O. attached.

Signed _____

Company Name _____

City _____ State _____ Zip _____

Phone _____ - _____

Lawn Size _____ Type of Business _____

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"CONTROLLED GROWTH THROUGH CHEMISTRY"

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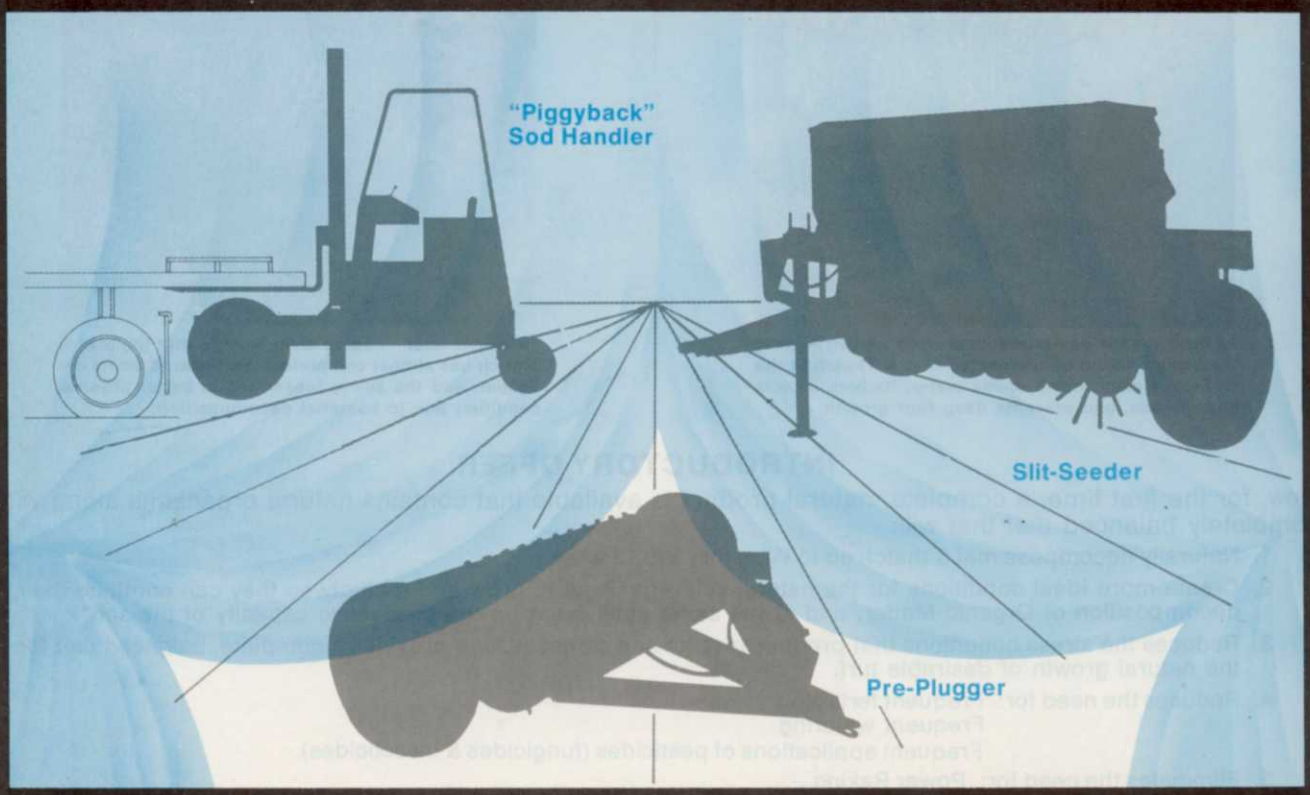
These and More... Unveiled at ASPA Convention



"Piggyback" Sod Handler

Newly developed by Princeton, this quality constructed Sod Handler is not only versatile... but **completely safe.** This mighty little machine will load and carry all day long in the field, then lift itself onto the back of your truck for a piggyback ride home. See it in action!

Unique Pre-Plugger

Vegetative growers ... increase your sod yield up to 20% with this innovative re-growth method. Now, discover how to harvest **all** of your sod. This proven machine eliminates the need to leave strips of perfectly good sod in the field for re-growth purposes. Let Princeton demonstrate how to harvest an additional acre from every five.

Extremely Efficient Slit-Seeder

With its new method of micro-seeding, this new Slit-Seeder can guarantee tremendous savings on any seeding job. Now use only 8-12 lbs. of seed per acre instead of up to 50 lbs! Just divide your normal yearly seed costs by three-fourths... then call Princeton for a demonstration.

For further information or demonstration write or call collect:

Rodger Osborne, General Manager
955 W. Walnut St.
Canal Winchester, Ohio 43110
(614) 837-9096

princeton mfg. company

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WT&T CLASSIFIEDS

When answering ads where box number only is given, please address as follows: Box number, c/o Weeds Trees and Turf, Dorothy Lowe, Box 6951, Cleveland, Ohio 44101.

Rates: All classifications 65¢ per word. Box number, $1. All classified ads must be received by Publisher the 5th of the month preceding publication date and be accompanied by cash or money order covering full payment. Mail ad copy to: Dorothy Lowe, Weeds, Trees & Turf, P.O. Box 6951, Cleveland, Ohio 44101.

USED EQUIPMENT

2 — 50' AERIAL BASKETS, brush chipper, stump cutter, 2 sprayers, small crane. Parkway Tree Service, 12026 West Cherry St., Wauwatosa, Wisconsin 53226. 414 257-1555.

STUMP GRINDERS, chippers, log splitters, sprayers, bucket trucks, all reconditioned. Let us know your needs. Essco, 5620 Old Sunrise Hwy., Massapequa, N.Y. 11758. 516 799-7619.

1-60' HI-RANGER, 2-53" Hi-Ranger, 1-Mitts Merril chipper, 2-Prentice loaders, 1-35 g.p.m. John Bean sprayer, 1-10 ton tri-axle trailer, 2-chipper trucks. 414 255-6161 or 354-8730 eve. Allied Enterprises, Inc., W 204 N11509, Goldendale Road, Germantown, Wisc. 53022.

USED HI-RANGER and other bucket trucks, Bombardier muskegs, Asplundh chippers, 100 ft. cranes and smaller and hydro-ax's. Please call or write P. C. Gould Sales Company, Box 178, Essex, Conn. 06426. Phone 203 767-1636.

M-50 VERMEER TREE TRANSPLANTER and front end loader, 4 wheel drive, diesel engine, 1½ years old, excellent, priced to sell. Call 616 984-2381.

1970 WHITE TRUCK with 72' Prentice 8T-2 Crane, gas driven, 15 speed road ranger, 16' dump bed. Excellent condition. $39,-500.00. Osborne Tree Service, Mentor, Ohio 44060. 216 255-9109.

No. 10 VERMEER STUMP GRINDER. New motor, guards, canvas, chain, belts, Jack shaft, paint, tires, battery, etc. $5,000. Firm. Priced near half of new. Jim Cook, 1023 Memorial Dr., S.E., Cedar Rapids, Iowa, 52403. 319 366-6874.

VEREER MODEL 18 stumper, just rebuilt $4000. John Bean mist blower $2500 or exchange for brush chipper any condition Smith Tree Service, 1809 Washington Ave., Portland, Maine. 207 797-4769.

USED EQUIPMENT. Brillion seeder model SSLF-96. Sowed only 23 acres merion. Equipment Locator. 516 722-3505.

USED AERIAL buckets for sale or lease. Used brush chippers, 100 foot Arlo cranes, 35' national crane. Bombardier Muskey $4,000. Call or write Jeff Gould, P. C. Gould Sales Company, Box 178, Essex, Conn. 06426. Phone 203 767-1636.

PRENTICE LOG & BRUSH CRANES: 3 model F machines, $3500.00, 1 model G machine, $4800.00, 1 model 40 Barko, $5400.00. All models have grapples and are price mounted on your truck plus power take off. Reply to: Madison Truck Equipment, 2410 South Stoughton Road, Madison, Wisconsin 53716, or call 608 222-5591.

FOR SALE: 10-1977 Chevy one-ton trucks, 750 gal. spray tanks, R&M 3L4 pump, electric hose reels, spray hose, ready to spray. Phone 513 845-0631.

HI RANGER AERIAL BUCKET. 52 foot 64 G.M.C., rebuilt and new paint. Ready to work. $18,500 or offer. 303 798-4773.

WORLD'S FINEST AND BIGGEST tree sprayer, custom built. 1800 gallon oval double wall stainless insulated on C-750 Ford. Air brakes, 60 GPM FMC pump, electric reel. Also Beck Lawn-A-Matic plugger and sprigger, 7 ft. wide, PTO driven. 513 424-2052.

FOR SALE: 7 gang Jacobson mowers. Phone evenings or weekend 517 663-1119.

1972 HI-RANGER 52' with chip box, Mitts Merrell brush chopper, 1560 Vermeer stump machine. Grant Moser, Ligonier, Ind. 219 894-4349.

SALE: 48' Skyworker on C-600 Ford, $8,-500.00. 35' bucket on F-600 Ford, $6,500.00. 65' bucket, no truck, $4,500.00. 201 922-9393.

HI-RANGER 52' on 1965 Ford truck, $8,-000.00 or trade for dump truck of same value. Richard Case 138 Sannita Drive, Rochester, New York.

FINN HYDRO SEEDER, 2500 gallon Titan model, mounted on Ford 750 tandem truck, 1963. Very good condition, $7,950.00 firm. Meyers Turf Farms, Inc., Box 69, Stilwell, Kansas 66085. 913 681-2667.

FOR SALE

74 CHEVY with 50' Skyworker, chip box, $18,900.00. 6 Cyl. 12" Torque converter reconditioned Mitts and Merrill, $3,300.00. Model 6 Vermeer stump-cutter like new, $2,395.00. 4 Cyl. 12" fully re-conditioned Asplundh, $3,500.00. Asplundh L-45 50' on Chevy dump box fully re-conditioned, 40,000 miles, $13,700.00. 16" Asplundh chipper, needs a motor, $1,700.00. Edwards Tree Service, 49090 Cooper Foster Park, Amherst, Ohio 44001. 216 988-4477.

FOR SALE: 7-gang Roseman hydraulic mower, excellent condition, complete, ready to mount on your 3000 Ford tractor, price $2000.00. 205 821-0969. Beck's Turf-Nursery, P.O. Box 752, Auburn, Ala. 36830.

WIRE STAPLES, 11 guage, 1000 per box, send $21.00 per box, F.O.B., Annapolis, Maryland. Wm. H. Foster Landscaping Company, 10 N. Taylor Ave., Annapolis, Maryland 21401.

FOR SALE: Ames ABC aluminum hand-move irrigation system. Will irrigate 2 ½-3 acres. Top condition. 2400 ft. of 6" main line, 40 ft. sections. With 44 4" 30 ft. laterals including 44 risers and sprinklers and all other necessary connections. Price $3500 or best offer. Contact Ray Sorensen, 3717 W. 74th St., Prairie Village KS or phone 913-384-1542.

TREE TRIMMING AND REMOVAL SERVICE. Going business established 25 years. Can make back investment in two years or less. $45,000 Nebraska area. Owner retiring. Box 221, Weeds, Trees & Turf, Box 6951, Cleveland, Ohio 44101.

FORKLIFT: International 350, all terrain, 3 stage mast. 4000 lbs. 1 513 848-2501.

BUSINESS OPPORTUNITIES

WANT TO BUY OR SELL a golf course? Exclusively golf course transactions and appraisals. McKay Golf & Country Club Properties, 15553 N. East St., Lansing, Michigan 48906. Phone 517 484-7726.

LEARN LANDSCAPING and the Growing of Plants at home. Start a satisfying business or hobby. Free booklet. Lifetime Career Schools, Dept. A-605, 2251 Barry Avenue, Los Angeles, Ca. 90064.

WANTED TO BUY

WANTED TO BUY: Aerial baskets, 50 ft. minimum, used chippers, 12 in., used Bombardier equipment. Contact Glenn Bennett at O. T. Corp. 313 727-7558.

WANTED—Truck with tree loader behind cab mount. 303 623-2658.

WANTED: 665 stump grinder. Edwards Tree Service. 216 988-4477.

MISCELLANEOUS

LANDSCAPE DESIGN KIT. 37 Rubber symbol stamps and ink pad. Postpaid $30.00; COD $32.00 plus postage. Order direct or brochure sent. California add sales tax. T-Gordon's, Box 741T, Reseda, California 91335. 213 881-2808.

TREE CARE by John M. Haller. Highly recommended, 224 pages, 175 photographs. Clear, simple language, detailed, practical, scientifically accurate. $9.95. 1236 College Ave., Modesto, Ca. 95350. Satisfaction guaranteed.

HELP WANTED

MANAGER AND APPLICATOR position open at new chemical lawn care division of established landscape maintenance company in fast growing Houston, Texas. Tremendous opportunity for those having experience with national or regional lawn care companies, knowledge of St.

Continues on page 84

Augustine lawns and marketing capabilities. The right people will have unlimited advancement potential. Send complete resume including education, experience and salary history to: Environmental, 7544 Harwin, Houston, Texas 77036 or call collect 713 784-1750.

RESIDENTIAL TREE CARE SUPERVISOR. We're looking for someone experienced and knowledgeable in all aspects of tree care — including corrective and sanitary pruning, cabling, bracing, cavity repair and pest control. Successful candidate will be proficient at climbing techniques and able to teach new workers all aspects of tree care. Please send a letter describing education and experience to Personnel Director, P.O. Box 1718, Des Moines, Iowa 50306. Equal opportunity employer.

GOLF COURSE TURF PRFESSIONALS: An opportunity to sell Pro Turf® products. ProTurf Division of O.M. Scott & Sons, the nation's leading manufacturer and marketer of professional turf products, has openings for Technical Representatives in several territories. The Tech Reps selected will call on golf course superintendents, requiring a knowledge of turf management and an understanding of these professionals' needs. Applicant should have a BS degree or equivalent in one of the agronomic sciences. Excellent starting salary plus bonus, automobile, and a comprehensive benefits program at no cost to employees go along with these positions. Send resume in confidence to Dick Stahl, Director of ProTurf, O.M. Scott & Sons, Marysville, Ohio 43040. An equal opportunity employer.

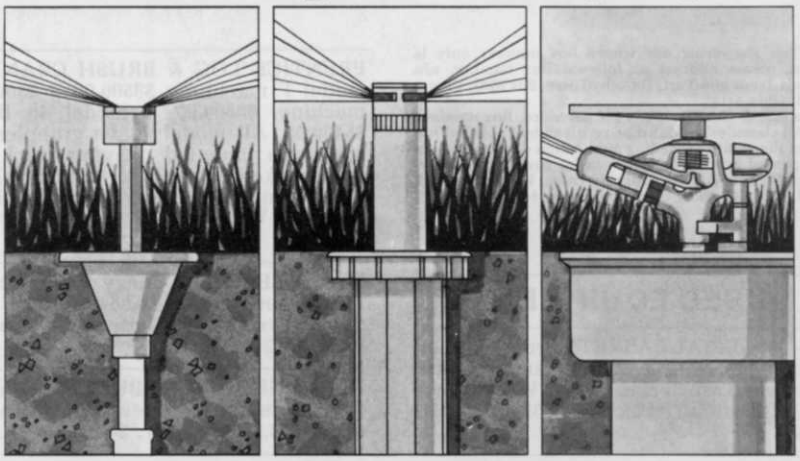
SEEDING/MULCHING COST ANALYSIS. What does seeding and mulching really cost? Is cellulose fiber cheaper? Straw? How much difference is there between one and twenty acres? This comprehensive cost study, excellent for estimating is only $3.00. Call 201 754-3343 or write N/K Associates, Box 249, Plainfield, N.J. 07061.

SEEDS

SOD QUALITY Seeds: Adelphi, Glade, Cheri, Nugget, Merion, Fylking, Majestic, Baron & Touchdown bluegrasses, also fine fescues. Manhattan ryegrass. Custom mixing available. Michigan State Seed, Grand Ledge, Michigan 48837. Phone 517 627-2164.

LAWN SEED. Wholesale. Full line of top quality grasses. Improved bluegrass varieties, fine fescues and fine bladed ryegrasses. We specialize in custom mixing. Oliger Seed Company, 2705 Wingate Avenue, Akron, Ohio 44114. Call collect 216 753-2259.

The taller the grass ...the higher we pop!



From residential to light commercial turf installations, Champion has a pop-up to do the job! When you compare the cost, precision construction and performance, you'll buy Champion. The 18HP (2" pop-up), the P180 (2½" pop-up) and the 6178 Impulse pop-up are just three of over one-hundred fifty sprinklers, valves, controllers and accessories featured in the new Champion, full-color catalog. Ask for your free copy.

CHAMPION SPRINKLER EQUIPMENT
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Los Angeles, CA 90012
(213) 221-2108/(213) 223-1545

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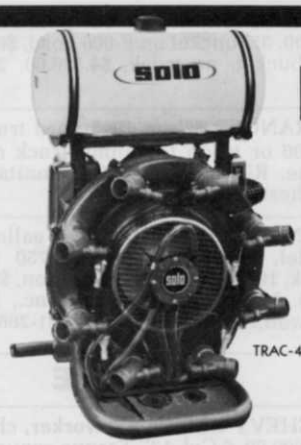
Do-it-yourself Mist Blowers from solo

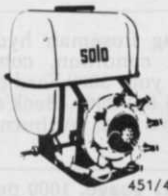


TRAC-419

Mount SOLO's TRAC-419 on your truck bed, trailer, ATV, or jeep. Add your own formula tank, and you've got a powerful 12.5-hp mist blower. (It will put defective, outdated air-blast spray rigs back to work at amazingly low cost!)

- Provides ideal coverage and saves through high-concentration, low-volume application
- Prepiped hoses, formula pump, return lines, and valves
- Economical discharge through 8 nozzles adjustable in flow rate and direction
- Add TELEBLAST nozzle for up to 50-ft. coverage in any direction
- Integral throttle control
- Weighs only 66 lb.

Send for free brochure or ask your dealer for SOLO.



Model 426 self-propelled Mist Blower; 32-gal. formula tank; 12.5-hp high-performance engine; standard cleat or ATV tires

Model 451/452 PTO Mist Blower; lightweight; 3-pt hitch to 15-hp or over tractor; 53, 80, 105-gal. formula tank

451/452

Also: manual or motorized backpack units

426RF

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EVENTS

The current issue of WEEDS TREES & TURF carries meeting dates beginning with the following month. To insure that your event is included, please forward it, 90 days in advance, to: WEEDS TREES & TURF Events, 9800 Detroit Ave., Cleveland, OH 44102.

New York State Nursery Convention and Trade Show, Niagara Falls, NY, **July 9-12.** Contact Margaret Herbst, New York State Nurserymen's Assoc., 101 Park Ave., New York, NY 10017, 212/685-4579.

Michigan Turfgrass Field Day, Crops Barn, Michigan State University, East Lasing, **July 10.** Contact: Dr. John E. Kaufmann, 322 Agriculture Hall, MSU, East Lansing, MI 48824.

Trees for the 80's, Dow Gardens, Midland, MI, **July 10,11.** Contact Dow Gardens, 1018 W. Main St., Midland, MI 48640.

Annual Meeting of the Aquatic Plant Management Society, Chattanooga Choo-Choo Hotel, Chattanooga, TN, **July 15-18.** Contact The Aquatic Plant Management Society, P.O. Box 2237, Fort Myers, FL 33902.

American Sod Producers Association, Summer Convention and Field Days. Hilton Inn East, Columbus, Ohio, **July 18-20.** Contact: Bob Garey, ASPA, Association Building, 9th and Minnesota, Hastings, NE 68901, 402/463-5691.

North Carolina Landscape Contractors Summer Meeting, Atlantic Beach, **July 20-22.** Contact NCLCA, 1110 Wake Forest Rd., P.O. Box 25891, Raleigh, NC 27611, 919/832-1498. For room reservation contact Holiday Inn directly, 919/726-2544 and say you are with NCLCA.

Penn Allied Nursery Trade Show, Hershey Convention Center, **July 24-26.** Contact: S. Howard Davis, 169 W. High St., Carlisle, PA 17013, 717/243-1786.

Massachusetts Turf Field Day, South Deerfield Turf Plots, **July 25.** Contact: Dr. Joseph Troll, Stockbridge Hall, University of Massachusetts, Amherst, MA 01003, 413/545-2353.

Turfgrass Research Field Day, Ohio State University, Columbus, OH, **July 31.** Contact Dr. Keith Karnok, 1827 Neil Ave., Ohio State University, Columbus, OH 43210, 614/422-2591.

ALCA Erosion Control Symposium, Kansas City, MO, **August 1-3.** Contact Associated Landscape Contractors of America, 1750 Old Meadow Rd., McLean, VA 22102. 703/821-8611.

Illinois Landscape Contractors Assoc. Summer Field Day, Kankakee Nursery, Aroma Park, IL, **August 8.** Contact Carole Rachesky, 665 Forst, Glen Ellyn, IL 60137, 312/858-8574.

American Association of Nurserymen Management Seminar, Ohio State University, Columbus, OH, **August 19-24.** Contact AAN, 230 Southern Building, Washington, D.C. 20005, 202/737-4060.

USDA Turfgrass Field Day, Beltsville, MD, **August 22.** Contact Jack Murray, Research Agronomist, Field Crops Laboratory, USDA, Beltsville Agricultural Research Center, Beltsville, MD 20705.

Farwest Show of nursery, garden and allied trades, Portland, OR, **August 24.** Contact Dan Barnhart, 503/221-1182.

International Garden Center Annual Congress, Helsinki, Finland, **August 25-Sept. 1.** Package plan cost $925 per person. Other tour options to Russia, Poland, Austria, and Czechoslovaka available. Contact Garden Centers of America, 230 Southern Building, Washington, D.C., 20005, 202/737-4060.

Midwest Agricultural Chemicals Association Annual Meeting, Chateau Louise, Dundee, IL, **September 4-6.** Contact Wayman Lipsey, executive director, MACA, P.O. Box 113, W. Burlington, Iowa 52655. 319/752-8441.

International Pesticide Applicators Assoc. Annual Convention, Thunderbird Motor Inn, Jantzen Beach, Portland, OR, **September 5-7.** Contact Steve Lind, 17515 S.W. 115th, Sherwood, OR 97140.

Pacific Horticultural Trade Show, Long Beach, CA, **September 6.** Contact Richard Staples, 1419 15th Street, Sacramento, CA 95814. 916/443-7373.

Interior Landscaping Symposium, Bel Air Hilton, St. Louis, MO, **September 19-21.** Contact Associated Landscape Contractors of America, 1750 Old Meadow Rd., McLean, Va 22102. 703/821-8611.

Planning and Budgeting Seminar, Airport Hyatt House, Los Angeles, CA, **Sept. 20-21.** Contact ALCA, 1750 Old Meadow Rd., McLean, VA 22102.

American Mining Congress 1979 Mining Convention, Los Angeles, **September 23-26.** Contact American Mining Congress, Ring Buildin, Washington, D.C. 20036, 202/331-8900.

Florida Nursery and Allied Trades Show, Florida State Fair Grounds, Tampa, FL, **September 28-30.** Contact FNATS, P.O. Box 16796, Temple Terrace, Florida, 33687, 813/985-8511.

New Jersey Golf Course Superintendents Assoc. Equipment, Irrigation, and Supplies Field Day, Rutgers University Stadium and Golf Course, Piscataway, NJ, **October 2-3.** Contact Dr. Henry Indyk, Rutgers University, Box 231, New Brunswick, NJ 08903, 201/932-9453.

Southern California Turfgrass/Landscape Equipment and Materials Educational Expostion, Orange County Fairgrounds, Costa Mesa, CA, **October 17-18.** Contact Ed McNeill, 1000 Concha St., Altadena, CA 91000, 213/798-1715.

Professional Grounds Management Society 67th Annual International Grounds Management Seminar and Trade Show, Baltimore Hilton, Baltimore, MD, **Oct. 21-24.** Contact Allan Shulder, PGMS, 19 Hawthorne Ave., Pikesville, MD 21208.

Southern Agricultural Chemicals Association Convention, Callaway Gardens, Ga, **October 28-31.** Contact SACA, P.O. Box 686, Dawson, GA 31742.

Continues on page 86

WT&T

EVENTS

National Institute on Parks and Grounds Management Annual Educational Conference, Music City, Nashville, TN, **October 28-November 2.** Contact NIPGM, Box 1936, Appleton, WI 54913.

Arborist Workshop, Texas A&M University, **October 29-31.** Contact university, College Station, TX.

Maintenance Symposium, Red Carpet Inn, Milwaukee, WI, **November 6-9,** Contact ALCA, 1750 Old Meadow Rd., McLean, VA 22102.

Wisconsin Park and Recreation Association Annual Conference, Playboy Resort, Lake Geneva, WI, **November 7-8.** Contact WPRA. 8320 W. Bluemound Rd., Suite 211, Wauwatosa, WI 53213.

New York State Turfgrass Trade Show, Syracuse, NY, **November 13-15.** Contact Janet Worthington Dudones, 50 Petrova Ave., Saranac Lake, NY 12983.

Planning and Budgeting Symposium, Ramada Inn O'Hare, Chicago, IL, **November 15-16.** Contact ALCA, 1750 Old Meadow Rd., McLean, VA 22102.

Design/Build Symposium, Kansas City, MO, **November 28-30.** Contact ALCA, 1750 Old Meadow Rd., McLean, VA 22102.

Massachusetts Horticultural Congress, Dunfey's Hyannia Resort, Cape Cod, MASS, **January 23-24.** Contact Deborah Fanning, 715 Boylston Street, Boston, MASS 02116. 617/266-6800.

ALCA Annual Meeting and Trade Exhibit, Town and Country Hotel, San Diego, CA, **February 3-8.** Contact ALCA, 1750 Old Meadow Rd., McLean, VA 22102.

Weed Science Society Annual Meeting, Toronto, Canada, **February 5-7.** Contact WSSA, 113 North Neil St., Champaign, IL 61820.

First Agri-Turf Irrigation Exposition and Technical Conference, Houston, TX, **February 24-27.** Contact The Irrigation Association, 13975 Connecticut Ave., Silver Spring, MD 20906. 301/871-8188.

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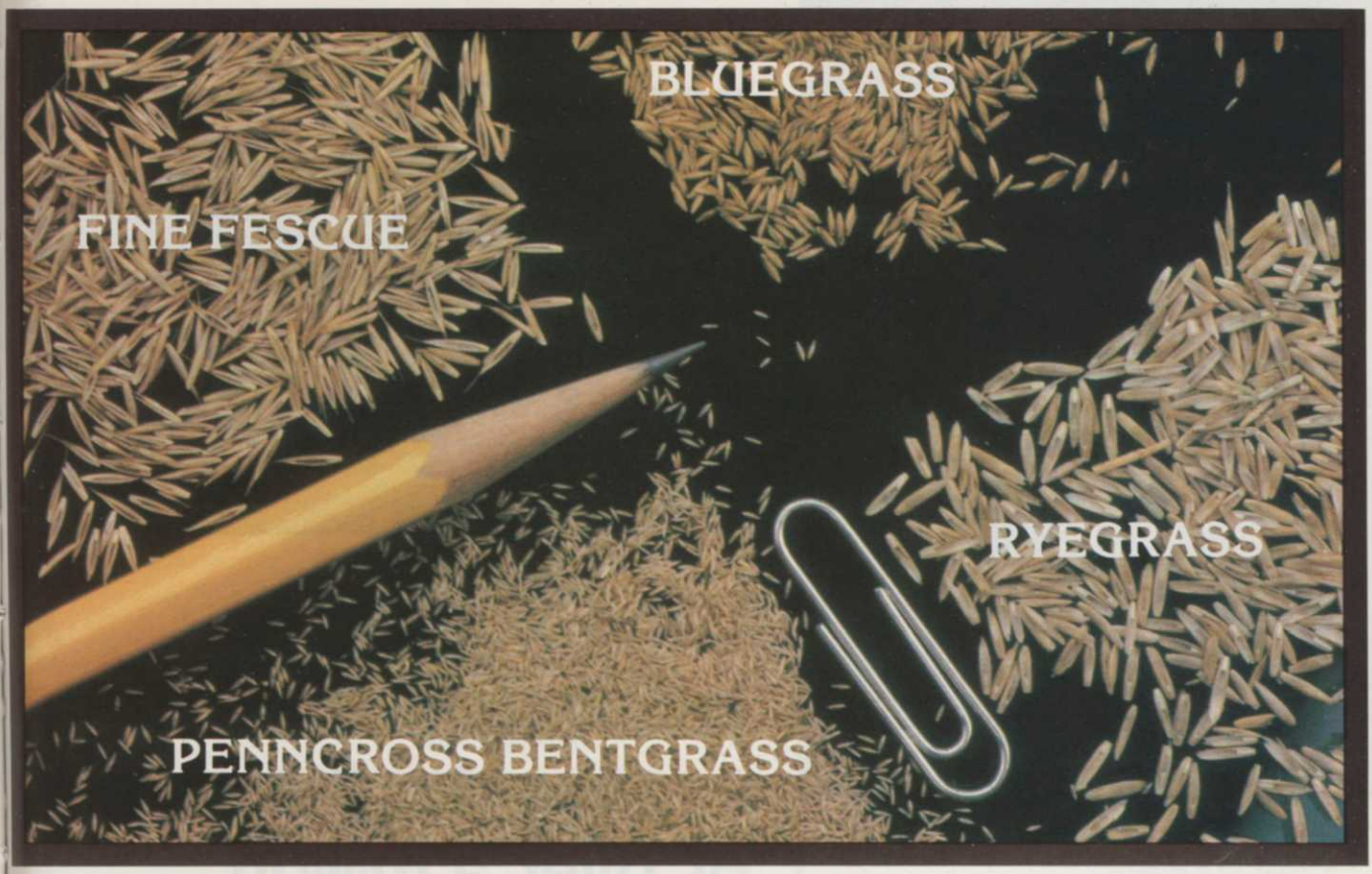

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